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CHILD DEVELOPMENT

The contents of this number include studies of responses of newborn infants, of the influence of pregnancy order upon early development, of children's block constructions and reactions to novel stimuli, and of popularity in preschool children.

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CHILD DEVELOPMENT

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Children's Reactions to Novel Visual Stimuli[1]

MARTHA VANCE ELLESOR

INTRODUCTION

THE purpose of the following experiment was: *First*, to determine what responses a two year old child will make to visual stimuli never before seen by the child; and *second*, to study the changes in the responses which occur with repetitions of the stimuli.

This experiment was planned for the purpose of testing to some extent the hypothesis of Watson that visual stimuli can arouse negative responses only by being conditioned to loss of support or to a loud sound.

In an experiment of this kind it is of primary importance that the past history of the subjects be thoroughly known, for only in this manner can the absence of conditioning to the stimuli used be ascertained. We were fortunate enough to secure 2 subjects who fulfilled this qualification.

APPARATUS

All experiments were held in a room located in the psychological laboratory. The room 8 feet by 8 feet was kept uniform in appearance, containing a table of convenient height for the children's use, 2 small chairs, 1 straight chair in which the experimenter sat, and 2 small rag rugs on the floor. The room contained no windows, and the door was kept closed during all experiments so that the subject was not distracted by stimuli from outside the room.

Extra toys and apparatus not used during a given experiment were kept in a small adjoining room.

The following stimuli were used:

1. *A devil's mask.*
   A red devil's mask, the size of a normal face and having a sharp chin, large pointed nose, and a black painted beard, fitted to a large doll (27 inches long).
2. *Brown fur.*
   The fur, made up for a neckpiece, and having claws, glass buttons for eyes, and a mouth which could be opened was dark brown in color and approximately twenty-four inches long.
3. *Flashlight.*
   The flashlight was nickel plated, 18 inches in length, and gave a relatively bright light.
4. *A movie.*
   The pictures were projected from a handcranked Vitascope Movie Maker (burning a 100 W. 115 V. Mazda projection lamp), the speed of which could be varied. The films used showed pictures of newborn infants in their cribs taken at the University of Virginia Hospital. Another film showed pictures of one

[1] The writer wishes to acknowledge her indebtedness to Dr. Wayne Dennis, under whose direction this research was performed, and to the parents of the subjects for their hearty coöperation which made the experiment possible.

subject, Mary, in the yard of her own home. The movies were presented to Elizabeth only. These particular films were chosen due to the fact that they consisted of pictures which the subject had seen before. Thus it was the movement of the pictures which comprised the unusual element. The pictures were projected against the white wall of the play room.

Toys were used to keep the subjects occupied when not reacting to the above stimuli. The reactions to these particular stimuli were not studied due to previous opportunities for conditioning, each subject being accustomed to play with similar toys at home. The toys were as follows: tin soldiers, a toy truck, marbles, a picture book, and colored wool yarn.

SUBJECTS

Two subjects, Mary and Elizabeth, were used in this experiment. The experiments were begun within a week after each child had passed her second birthday.

Both children were from professors' families at the University of Virginia. The subjects, robust, strong, and emotionally stable children, had always been under the constant care of their parents. It was therefore definitely known from their past history whether or not the stimuli were novel to them. The subject, Mary, had been accustomed to visiting the psychological laboratory from early infancy.

Mary had seen a devil's mask at a time previous to the first time she saw the one in the experimental room, but we have a cinema record of the crying which this unusual stimulus produced. Elizabeth also had on one previous occasion seen a Santa Claus mask, the appearance of which caused her to retreat into the opposite room.

Neither subject had seen a flashlight, but each was accustomed to electric lighting in the home and to automobile lights, so that the flashlight was not highly unusual.

With regard to previous experiences with stimuli similar to the brown fur, it is noteworthy that the subject, Mary, had been afraid of cats and dogs previously without conditioning, but this fear had disappeared before this experiment was conducted. Elizabeth, having been accustomed to dogs and cats from early infancy, had never shown any fear of such animals.

Mary's initial reaction, crying, upon seeing a movie for the first time later suggested the use of a movie as an unusual stimulus for the second subject, Elizabeth, who had had no experience with this or similar stimuli.

PROCEDURE

The examiner became acquainted with each subject by several visits to the home of each. On the first visit to the laboratory, as on all other experimental days, the subject was taken immediately into the experimental room and given samples of colored wool to play with.

The first 7 visits in the case of one subject, and the first 4 visits, in the case of the other subject, were to acquaint the child with the room, and to interest her in making visits to the laboratory.

The subjects were experimented with individually. The experimenter kept herself as passive as possible in relation to the child when she was in the

experimental room. She talked to the child only at times indicated in the procedure.

The subject was never given any suggestion as to what she would see when she entered the room, and no remarks in regard to the stimulus were made after entering.

The experimenter sat in her chair in the corner of the room, and noted all items of the child's behavior so far as she was able to represent them. This was done during all preliminary as well as during all experimental periods. The more usual responses were recorded in short symbols. Each reaction was recorded as it occurred except in instances in which the experimenter was engaged in handling the stimulus. In each such instance the reactions were noted immediately afterward, during the same experimental period.

The experiments were conducted at approximately the same hour each morning.[2]

The subjects were never allowed to play in the laboratory; they were taken home immediately after leaving the experimental room each day. The length of each day's experimental period was determined either by the child's expressing a desire to go home, or when, according to the experimenter's judgment, the child had become tired of playing in the room.

The subjects were experimented with every day during part of the experimental period, but during the remainder of the time it was only possible to experiment with them on Tuesday, Wednesday, Thursday and Friday of each week. The exact days of experimentation are shown by the charts to be presented later.

In general, each stimulus was repeated on successive days until the child had lost interest in that particular object. The presentations of one stimulus were completed before a new stimulus was introduced, except in one instance. With Elizabeth acting as subject, the flashlight was introduced before she had lost interest in the mask.

The procedure with the various stimuli and the order in which they were presented were as follows:

Procedure 1

Devil's mask. The subject was given a large doll to play with for two successive preliminary periods in the play room by the end of which time the child had become accustomed to and very fond of the doll.

On the third (first experimental) day, previous to the entrance of each subject, the experimenter placed the doll in a sitting position in one of the small chairs opposite the door through which the child entered. The mask was fitted loosely to the face of the doll so that the child might easily remove it. The subject was asked to come into the room to play, and upon entering she immediately saw the doll to which the mask was fitted.

In case of crying and running to the experimenter, she was given either marbles, a toy truck, or a tin soldier with which to play. This was done in order to keep the subject in the room.

With Mary acting as subject in this situation, the experimenter had to remove the mask from the doll on the

[2] The time required for the performance of this experiment was approximately one hour a day for six months.

first 2 days in order to quiet her crying and her desire to leave the play room immediately. In this case the mask was placed on the table in the room so that it remained in view of the subject. After the first 2 days, however, the experimenter did not remove the mask. At the subject's request, the experimenter accompanied Mary the first few times she herself removed the mask.

In the case of Elizabeth, the experimenter did not find it necessary to remove the mask for the child.

Procedure 2

Flashlight. A large flashlight was placed on the table in the experimental room. When the subject discovered, of her own accord, that the light would operate, the experimenter assisted her in punching the button so that the light would stay on.

The experimenter, having accustomed the subject to occasional darkness in the room for 2 days prior to the presentation of the flashlight, now turned off the light in the experimental room as the child threw the beam of the flashlight about the room. Upon the subject's request, the experimenter would again turn on the light.

Procedure 3

Brown fur. The subject was brought into the play room to find a toy truck and tin soldier on the table.

The experimenter took a seat in her chair on the back of which the fur had been hung. As the child was engaged in playing with toys on the table, the experimenter approached her with the fur, and then placed it on the table.

Later when the child began to manipulate the fur, the experimenter found it necessary to assist her in opening the fur's mouth, which consisted of a clasp too strong for the subject alone to operate.

With the repetition of the stimulus on successive days the fur was always placed on the table so that it was in full view of the child from the time she entered the room.

Procedure 4

Movie. The handcranked Vitascope Movie Maker was placed on the table in full view of the subject as she entered the room on the first preliminary day. In addition to the movie maker, a toy truck and picture book were found on the table.

After the subject had investigated the movie maker and turned her attention to the toys on the table, the experimenter began turning the handcrank of the machine, which contained no film at this time, in order to accustom the child to the noise made by turning the crank. Later during this same first period, the experimenter turned out the light in the play room and continued turning the crank.

On the second preliminary day, the experimenter placed a film in the machine and regulated it so that the picture of a newborn infant was clearly projected on the white wall when the light switch connected with the machine was plugged in an electric socket. After the child had entered the room and begun to play, the experimenter turned off the light in the room and plugged in the switch, but did not turn the crank.

On the third day (first experimental day) the child found the machine set up as on the preceding day. Again, as she was engaged in playing with the

toys in the room, the experimenter turned out the light and plugged in the switch. This time she began turning the crank which caused the pictures projected on the wall to move. the behavior which occurred during "experimental" periods. A list of responses is shown at the left hand side of each table and the x's to the right of each response indicate the

TABLE 1

Reactions to mask

REACTIONS	MARY															ELIZABETH												
	February												March			April												
	9	10	11	12	16	17	18	19	23	24	25	26	1	2	3	4	12	13	14	15	16	19	20	21	22	23	26	27	28	29
Startle	x																x													
(Stopping just inside door)	x	x	x																											
Frowning	x	x															x	x												
Retreating	x	x															x													
Crying	x	x															x													
Whimpering	x																x													
Fretting	x																x													
Stopping half-way		x															x													
Reluctant approach		x	x																											
Cautious manipulation		x	x																											
Quiet			x																											
Approach				x	x	x	x	x	x	x	x	x	x				x	x	x	x	x	x	x	x	x	x				
Manipulation				x	x	x	x	x	x	x	x		x					x	x	x	x	x	x	x	x	x				
Investivation					x												x	x	x											
Smiling				x	x	x	x	x	x	x									x	x	x		x	x	x					
Laughing									x	x	x	x	x									x	x		x	x	x			
Playing						x	x		x		x	x	x													x	x			
Kissing mask						x			x																					
No response														x	x	x												x	x	x	x

On the following days the procedure of the third day was repeated.

RESULTS

The experiments described above yielded responses which are presented in tables 1–4. These tables show only days on which the response occurred. We must define some of the less common terms denoting the reactions. By "startle reaction" we mean an upward and outward throwing of the arms, often accompanied by a catching of the breath and closing the eyes. "In-

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vestigation" denotes examination of the stimulus in an exploratory and cautious manner, whereas "manipulation" denotes operating or merely handling the object in more or less passive manner. By "playing" we mean handling the stimulus in a lively and interested manner. "Stopping half-way" is the term chosen to describe the reaction in which the child starts to approach the stimulus and suddenly stops. "Quiet" is intended to describe the subject as she looks calmly at the object from a safe dis-

TABLE 2

Reactions to flashlight

REACTIONS	MARY								ELIZABETH										
	February				March				April										
	19	23	24	25	1	2	3	4	12	13	14	15	16	19	20	21	22	23	24	27
Approaching	x	x	x	x	x				x	x	x	x	x	x		x				
Investigation	x								x	x										
Manipulation	x	x	x	x	x					x	x	x	x	x		x				
Smiling	x	x	x	x	x				x	x	x									
Kissing light		x																		
Playing		x	x	x						x	x	x	x	x		x				
Laughing	x	x	x							x	x	x	x	x						
No response						x	x	x							x		x	x	x	x

TABLE 3

Reactions to brown fur

REACTIONS	MARY										ELIZABETH										
	Feb-ruary			March							April				May						
	24	25	26	1	2	3	4	5	6	7	8	27	28	29	2	3	4	5	6	7	9	10	11
Retreating	x	x	x									x											
Nervous laughing	x																						
Frowning	x	x	x									x											
Whimpering												x											
Crying	x																						
Stopping just inside door												x											
Stopping half-way												x											
Reluctant approach		x											x										
Cautious manipulation		x											x										
Approach		x	x	x	x	x							x	x	x	x	x	x	x				
Investigation		x	x	x									x										
Manipulation			x	x		x								x	x	x	x	x	x				
Smiling			x	x	x	x							x	x	x		x						
Laughing				x	x	x									x	x	x	x	x				
Playing			x	x	x	x									x	x	x	x	x				
Kissing fur				x	x	x																	
No response								x	x	x										x	x	x	x

TABLE 4

Reactions to movie

REACTIONS	ELIZABETH				MARY
	April			May	
	27	28	29	4	
Stopping just inside door	x				Mary, at a time previous to this experiment, cried at the first presentation of this stimulus without having been conditioned. With repetition she later showed interest in movies
Frowning	x				
Fretting	x				
Retreating	x				
Quiet	x	x			
Stopping half-way	x				
Approaching	x	x	x	x	
Smiling		x	x	x	
Pointing to objects in pictures			x		
Asking for repetition		x	x	x	

tance. The tables do not distinguish between days on which a given response occurred only once and days on which it occurred more than once. The list follows roughly the order in which the responses usually occurred.

These tables show the following facts:

1. The first presentation of each stimulus, except the flashlight, elicited a crying response. In the case of the flashlight, the first presentation elicited approach and smiling. The children never cried at any other times throughout the course of the experiments than those shown by the tables.
2. During the early presentations of each stimulus a number of reactions occurred in each experimental period.
3. On each day, with few exceptions, the reactions begin at a higher point on the list and go down to a lower point on the list than the last response of the previous day. With repetition of the stimulus crying and other negative responses gradually disappeared, and other responses replaced them in a fairly consistent order. From day to day crying, retreating, whimpering, etc., disappeared and the subject manifested responses of investigation and examination. Upon further repetition such responses as laughing, smiling and playing with the stimulus were present. Still later the stimuli elicited no interest on the part of the subject. The movie was not presented to the point of loss of interest, but in all probability this stimulus would eventually have reached the same level as the others.
4. The responses occurred in a fairly definite order. This is not indicated by the tables themselves and consequently deserves some comment.

It is noteworthy that a startle reaction, if it occurred, preceded all other reactions. Within each experimental period, retreating, crying, whimpering and fretting always preceded approaching, smiling, and laughing. However, in the case of other reactions, the order was not invariable. For example, smiling sometimes preceded, at other

times followed, and at still other times accompanied approach, investigation or manipulation. The subject never manifested loss of interest in a stimulus until she had responded to it for a number of experimental periods.

SURVEY OF LITERATURE

A survey of the literature reveals many observations of children's reactions to unusual visual stimuli, but few experimental studies have been conducted. The following typical previous observations have been taken mainly from biographical studies since only in these cases can the history of the subject in regard to the stimuli used be ascertained. The subjects in each of these studies were under two and a half years of age. We feel that in general the literature reviewed below agrees very well with the results presented in this paper.

Preyer (1888) recorded crying in response to the following stimuli: persons dressed in black, masked faces, and the first sight of the sea.

Sully (1895) reported crying in a child upon its being taken into a *new* nursery, at the sight of a Japanese doll, and at the sight of an ugly doll.

Dearborn (1910), in observing his girl, reported fear of strangers, fear of the dark, and fear of a favorite doll which had been torn. She also refused to touch a porcelain doll which had lost its head.

Stern (1924) recorded fear in his child of a parent dressed up as an elephant, although no fear of a real elephant had been shown.

Bühler, C. (1928) observed negative reactions in response to a mask placed in front of the face of the observer which had previously been visible.

Washburn, R. W. (1929) found that infants, who had smiled or laughed in response to her tests for laughing and smiling, ceased to do so at about four months of age. She interpreted this failure to smile as due to the infant's new distinction between familiar and unfamiliar persons.

Valentine's daughter (1920) cried at the sight of her brother dressed in his black cat fancy dress costume, and also upon her first visit to the sea. By the end of a week at the seashore, however, she loved to paddle in the water.

Watson (1920) reported the case of the infant, Albert. The child was confronted suddenly and for the first time successively with a white rat, a rabbit, a dog, a monkey, with masks with and without hair, cotton wool and burning papers. A record of the infant's reactions showed that manipulation was the most usual reaction elicited and that at no time did he show fear to any visual stimulus.

Negative results, however, are not always conclusive. Watson stated that Albert was, on the whole, stolid and unemotional, that no one had ever seen him in a state of fear, and that the infant practically never cried. Other children may have manifested different responses than those of Albert. Again, the fact that the infant showed no fear at the age at which he was tested offers no proof that this fear may not have manifested itself at a later age.

Interpretation

Watson (10) would explain crying reactions to all stimuli other than loud noises, falling, and restraint on the basis of conditioning, but in this study there was no opportunity for the subjects' crying to have become condi-

tioned to the stimuli we used. No crying aroused by some other stimulus had even been associated with either the mask, the flashlight, the fur, the movie, or any similar stimulus. The fact that one or both of the subjects had once cried in response to these stimuli before the beginning of the formal experiment does not constitute conditioning. It will be noticed that the claim that our subjects were unconditioned refers only to the stimuli of the kind we used. While it may seem impossible to be absolutely certain of this claim, we do feel that the parents' knowledge of these children was extremely trustworthy.

We are forced to interpret the results outlined above as arising not from conditioned stimuli but from *novel* stimuli. We do not claim that the subjects of the study would have cried at all novel stimuli. However, the one stimulus which did not arouse crying, the flashlight, is not necessarily an exception because the children were accustomed to similar lights. Just what kinds of novel stimuli would not have elicited crying the experiment does not determine. Our only contention is that some novel visual stimuli elicit crying in some children in a manner which cannot be explained by conditioning. We do not claim that all children are alike in this respect.

We hesitate to call such crying instinctive because it may be that the effectiveness of the visual stimulus is due not to the stimulus itself but to the child's *association with dissimilar objects*. It may be the contrast with the familiar which is effective. This is a type of interpretation favored by many of the observers which were cited in the survey of the literature.

Next to Watson's theory, probably the most prominent one, is that of Jones and Jones (3). They maintained in connection with their study that changes in the total situation required a sudden new adjustment which the individual was unprepared to make, and that repetition facilitated readiness and ability to adjust. But the stimuli used in the present experiment required no sudden adjustment which the subject was unprepared to make. In the case of the mask, the flashlight, the fur, or the movie, the practiced reaction was that of merely looking at the object—a reaction which the child was fully capable of making at the time of the first presentation.

Thus far we have discussed chiefly the initial negative response of crying. The later ones are no less important, and it seems scarcely necessary to point out that their appearance, too, is inconsistent with the conditioning theory. The smiling and laughter which appeared upon the later presentations of the strange stimuli were not conditioned to the strange stimuli through their association with other objects. The familiar objects in the room had ceased to call out these responses long before the novel stimuli were introduced.

M. C. Jones (4) in her study of methods of eliminating children's fears cited one case in which the initial negative response of a subject disappeared with repeated stimulation. She is not inclined to believe that repeated stimulation will call forth *positive* responses, however, because she associates repeated stimulation with the process of negative adaptation which is supposed merely to end a given response, not to change it. We would, however,

raise the question as to whether the concept of negative adaptation itself is not in error. Repeated stimulation in the present study finally brought new and positive responses, as perhaps it would have done in Jones' study had it been used more extensively. Perhaps we should think of negative adaptation of the prepotent responses as the means by which less strong antagonistic responses are released.

On the neurological side the interpretation of each series of responses should probably be as follows. The presentation of a visual stimulus never before seen (and unlike any familiar stimulus) sets up multiple antagonistic cortical excitations, and the reaction, crying, was the result of the prepotent excitation. With repetition of the stimulus, crying became negatively adapted and other reactions, approach, manipulation, and smiling appeared as a result of unfatigued cortical excitations. Some spontaneous recovery of each response occurred from day to day. Upon further repetition these reactions became negatively adapted with relative permanency until finally no response occurred.

Since newborn infants do not cry in response to the stimuli here used it is probable that a certain amount of cortical development is required before the above principles can operate.

SUMMARY

This experiment was planned for the purpose of testing to some extent the hypothesis that visual stimuli arouse crying only through a process of conditioning. An effort was made to determine what reactions two children would make to certain stimuli known to be unusual to them, and to study the changes in the reaction which occurred with repetitions of the stimuli. The subjects were experimented with individually.

The following stimuli were presented in the order in which they are listed, the experiments with each stimulus being completed before the next stimulus was introduced: a devil's mask, a flashlight, a brown fur, and a movie. Each stimulus was repeated on successive days until the child had lost interest in that particular object.

The results of the experiment were as follows:

1. The first presentation of each stimulus, except the flashlight, elicited a crying response.
2. During the early presentations of each stimulus a number of reactions occurred in each experimental period.
3. With repetition of the stimulus crying and negative responses disappeared and the subject manifested responses of investigation and examination. Upon further repetition smiling and laughter were present. Still later the stimuli elicited no response on the part of the subject.
4. The responses of any single day had a fairly definite order of appearance.

The results are interpreted as showing that not all responses to visual stimuli are acquired by conditioning. Either some visual stimuli cause crying in themselves (when a child has reached a certain age) or the contrast between the familiar and the unfamiliar causes crying.

The results are also interpreted as showing that repeated stimulation is capable of causing negative to be replaced by positive responses.

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Visual Pursuit in 109 White and 142 Negro Newborn Infants[1]

W. C. Beasley

THIS report is the first of a series concerned with investigations of related problems in the vision of newborn infants. The program of research being conducted by the writer is directed toward a solution of some of the problems arising from the following considerations:

At what stage of development are the various oculo-motor processes during the first few hours subsequent to delivery? The "various processes" include: (*a*) negative movements of the eye-balls to light, (*b*) protective eye-lid reactions, (*c*) iris reflexes, (*d*) accommodation of the lens, (*e*) squint, or incoördinate binocular movements, (*f*) binocular fixation of stationary objects, (*g*) binocular fixation of successively displaced objects, (*h*) binocular convergence (adaptive to changing distance of object), (*i*) binocular pursuit of continuously moving objects. There are quite possibly other important functions, which will arise in the course of investigation applied to these. To what extent are significant individual differences exhibited at this early period, and if they are marked with what known factors can they be correlated? Certain of these possible factors are: (*a*) race, (*b*) good stock as indicated by the "vitality" or more specific organic or glandular characteristics of the parents, (*c*) nutritional factors of the mother during term, (*d*) conditions of delivery. These are only suggestive of pertinent items, which may yield important relationships.

At what age levels do significant changes from the birth condition occur? Which processes develop first, most rapidly? What intercorrelations between these processes and other behavior obtain? What influence has early practice upon accelerating the development of these functions? For example, does practicing binocular pursuit reduce the age at which certain standards of pursuit are attained? Or does lack of practice advance the age at which certain standards of performance are usually reached? Problems are here in large number; they are definite and important. They are practically untouched, insofar as systematic research is concerned. In the literature one finds only occasional sampling taken with reference to each of the problems and processes mentioned above. The fundamental problems remain unsolved. A step in the

[1] These experiments are being conducted in the Women's Clinic of the Johns Hopkins Hospital. The writer is appreciative of the coöperation extended by the Staff of the Department of Obstetrics, and particularly by Dr. J. M. Bergland, Dr. I. Hofbauer and Dr. F. F. Snyder.

right direction is the fairly recent study by McGinnis (1). Although only six subjects were used throughout the experiment, accurate measurements of permanent value were made. The reader is referred to his bibliography and review of the literature on ocular functions in infants. These remarks are meant to apply only to the investigation of vision in infants. Numerous meritorious publications on other branches of infant behavior have appeared during recent years.

Although the writer has accumulated data on several hundred infants for several of the functions mentioned above, the present report is concerned with visual pursuit. The infants were examined in a special experimental cabinet measuring 30 inches wide by 42 inches long by 40 inches high inside. Only one side was open, over which a curtain was hung. This cabinet was mounted on a table of approximately the same breadth and length as the outside dimensions of the cabinet, the whole structure being painted white. The legs of the table were equipped with 4 inches by 1 inch rubber-tired casters, so that the experimental set-up could be moved from one floor of the hospital to another. Inside the cabinet was placed a crib-like platform, measuring 22 inches by 30 inches by 4 inches, and having a concave surface. On this was placed appropriate padding to insure comfort for the infant which would be equivalent to that supplied by the nursery crib. The cabinet was wired for interior overhead illumination.

The procedure for studying visual pursuit in these infants was designed so as to make possible (*a*) measurements on a large number of subjects, (*b*) comparisons of pursuit with directly transmitted and reflected light with either a dark field or an illuminated one, (*c*) designation of definite standards of pursuit so that other investigators who so desire can duplicate the measurements, (*d*) the inclusion of three types of motion of the object with reference to the median plane of the infant's head, i.e., horizontal, vertical and circular, (*e*) a variation of the rate of motion of the object and its distance from the infant's head, (*f*) the designation for tabulation purposes of what constitutes a single "test."

Since funds were not available for building apparatus with automatic controls and recording units, the very simplest sort of means were utilized for fulfilling the above requirements. Three stimulus objects were used always in the same way. For the tests of pursuit with directly transmitted light in a dark field a small fountain-pen flashlight was used within the darkened cabinet. Over the bulb in the end of the flashlight three layers of tissue paper were tied, so that the stimulus object in the dark appeared as a faint circular spot of diffuse light about 1.5 cm. in diameter. The second test object may be characterized as fluttering, flickering or moving fingers. The experimenter's hand was moved across the field, the fingers executing alternating movements continuously. The third object was a dark blue cylinder, 2 cm. in diameter and seven inches long. The second and third test objects were always presented in a faintly illuminated field. A single 25 watt Edison Mazda

bulb which had been dipped in ordinary theater blue dye was used in a socket in the top of the cabinet 32 inches above the infant's face and 12 inches to the infant's left.

For making records of pursuit elicited a simple schematization was devised. The records were written on standard 6 inches by 9 inches cardboard filing cards, immediately following each test. In recording instances of horizontal pursuit, a vertical line one inch long was drawn on the record card to represent the sagittal plane of the infant's head. Horizontal lines were then drawn with reference to this vertical one to indicate through what extent of the field from extreme right to left or vice versa the pursuit continued. For example, if the infant followed the object across the field from a position immediately in front of his face when he was looking up to the extreme right, the object being moved in a circular arc having its center at the infant's nose, a line was drawn on the card from the vertical reference line to the right. Above the line was written 90°, indicating that the infant had followed the object all the way down to the plane of the crib on which he was lying. This pursuit would require several successive eye fixations and from two to four head adjustments. It was not at all difficult to observe the number of head adjustments, and some of the eye adjustments could be directly counted. Along the line a check mark was placed for each eye adjustment observed, and an x mark for each head adjustment. The records are in error in so far as they do not contain all that happened. What was recorded had happened, but no doubt movements, especially small adjustments of the eye-balls occurred which could not be observed directly by the experimenter. If the infant followed an object from the center of the field to the extreme right and back to the center continuously, arrow heads were placed on the record lines to indicate that the pursuit had been continuous in two directions, one following the other. A similar technique was used for recording vertical pursuit, except that the reference line was horizontal and the pursuit lines were vertical. In recording circular pursuit, a circle was sketched on the record card to indicate the path of the moving object. Cross-marks indicated the positions in the field at which pursuit was begun and terminated. Checks were placed in the positions where eye fixations were observed, and x's again where head adjustments occurred.

The procedure in making a test of horizontal pursuit was as follows: in the case of a test with the flashlight, the spot was moved slowly in the region where the infant's eyes were apparently "looking" until apparent fixation of the object was obtained. It was then moved to the right, usually at a rate of approximately one inch per second at a distance of from six to fourteen inches directly in front of the infant's eyes, then back to the left then to the right through short distances (one to two inches). This was done until successive fixation was obtained. If the infant's eyes followed for a movement of one or two inches, the object was moved further in the same direction. If when this was done, the infant did not continue to

follow the object, more bracketing back and forth was done until another indication of pursuit appeared. This sort of procedure was repeatedly carried out for several minutes, sometimes eight to ten minutes, with no pursuit beyond one or two slight successive fixations exhibited. And, frequently, when the experimenter was at the point of dispensing with the subject at hand and obtaining another one or two more trials would be given and 90° pursuit or more elicited. It is certain that from the procedures required in these experiments in order to elicit pursuit, if an automatically controlled continuously moving stimulus object were set moving in the field, even at this slow rate, very few instances of pursuit would be elicited. The most crucial part of the procedure is to obtain fixation of the object and then not to move it in the field too rapidly following this. Once continuous pursuit is obtained for several successive eye and head adjustments, the object is moved to the extreme right then back to the extreme left, the "test" ending when pursuit ceases. It is important also *not* to maintain the distance of the object from the infants eyes constant. There are interesting suggestions in this fact. It was repeatedly observed that some infants followed the object better at twelve to fourteen inches, others at from six to eight inches. Is it not likely that there are variations in accommodation present at this age that would determine partly at least optimal distances for objects of any size? A similar procedure was used for horizontal pursuit tests with the moving fingers and with the dark cylinder. The latter test object was always held so that its long axis was parallel to the sagittal plane of the head during horizontal tests.

An identical procedure was used for tests of vertical pursuit with simply a change in the directions of motion of the test objects. The dark cylinder in vertical pursuit was held so that its long axis was perpendicular to the sagittal plane of the infant's head. The same specifications apply to tests of circular pursuit. The circular path through which the test objects were moved had a radius of about ten inches centering at the infant's nose. Usually, some type of horizontal or vertical pursuit preceded the circular. Although the path of motion of the stimulus is designated as circular, it was not so in the actual mathematical sense. The actual path probably was more that of the outline of a six or eight pointed star. Deviations from the circular path were necessitated by the tendency of the infants to make fixations out of line with the circle. The experimenter in this case would move the object in or out, really assisting the infant's pursuit.

In the tables which follow, 4 types of pursuit have been designated which are based upon the following quantitative considerations characterizing each "Type."

Type A. This type of pursuit is characterized qualitatively as excellent. From the record cards, all instances of pursuit which exhibit the following minimum requirements have been classified as Type A. (1) In horizontal pursuit a minimum of 90° across the field, involving several successive eye fixations and several successive head adjustments correlated

with the direction of motion of the stimulus object and a *return* in the opposite direction of an equivalent extent. There were numerous instances of pursuit where the infant would follow the object 180° across the field two or three successive times back and forth, turning the head completely to the right or to the left. A well-known experimental psychologist observed this one day with a two-day old infant and remarked, "I would never have believed it." (2) In vertical pursuit a minimum of several successive eye fixations and several head adjustments in the same direction followed by several in the opposite direction continuously correlated with the direction of motion of the stimulus. (3) In circular pursuit a minimum of continuous following of the object until it has completed the circuit around the field, involving both eye and head adjustments.

Type B. (1) In horizontal pursuit a minimum of 90° across the field in one direction, involving both eye and head adjustments in the direction of the moving stimulus. (2) In vertical pursuit several successive head and eye adjustments in the same direction of the moving stimulus. (3) In circular pursuit, continuous following for at least half the circuit around the field. This type of pursuit has been designated qualitatively as good.

Type C. (1) A minimum of 3 successive eye fixations of the object without head adjustments for horizontal, and (2) the same for vertical. (3) For circular, several successive eye fixations with one or two head adjustments, but failure to pursue the object for more than one-fourth of the circuit around the field.

None. In all instances where less than three successive fixations correlated with the direction of motion of the stimulus were elicited, the responses were classified as "fixation" but not pursuit.

Pursuit tests were given altogether to 109 White infants and to 142 Negro infants, ranging in age from 2½ hours to 12 days. Attention should be called to the fact that the infants in this study which are classified as "Negro" are so termed because they were born in the Negro Clinic. The writer is perfectly cognizant of the problems involved here in racial intermixture. In most cases, the mothers were uncertain of their own family history beyond one or two generations. Physical traits became the only index in such cases, and unfortunately we do not have infallible standards in this respect. Skin color, eye color and hair type seem to supply the most reliable index to purity of stock. Data on each of these factors have been taken for all of the infants used in this study, and will be published in connection with other material soon. Roughly, about 30 per cent of the Negro infants used in this study exhibit the three features mentioned in a manner characteristic of the newborn in "pure" stocks.

Table 1 exhibits the complete data on pursuit in the White infants, and table 2 that for the "Negroes." Reading across the first row of tabulations in table 1, one makes the following interpolation: seven infants were examined for the first time 5 hours or less after delivery. None of these seven was re-examined within this period. These seven infants were given 17 tests with the flashlight (FL),

of which 6 were for horizontal (H) pursuit, six for vertical (V), and five for circular (Cr); they were given 9 tests with the moving fingers (MF), of which 3 were for horizontal pursuit, 3 for vertical, and 3 for circular; they were given 12 tests with the dark cylinder (DC), of which 4 were for horizontal pursuit, 4 for vertical, and 4 for circular. A total of 38 tests was given to these 7 infants within 5 hours after delivery. Of these, 13 were for H pursuit, 13 for V, and 12 for Cr. Of the 13 H tests, 6 were FL, 3 were MF, and 4 were DC. All together, at this age level with the seven White infants, there were 5 cases of Horizontal Type A (Excellent) pursuit responses elicited (5 H- Type A) from a total of 13 H-tests. Of these 5 H-Type A responses, there were 2 FL, 1 MF and 2 DC. From the remaining 9 H-tests at this age level, there were 3 H-Type B, 3 H-Type C pursuit responses elicited. There were 2 failures as listed under "None" horizontal. This example should make clear the procedure in reading the tables.

The row of "Totals" in table 1 yields the following information: there were 109 different White infants tested, 95 of whom were re-tested. There were 829 tests given, the computed number of tests per subject being 7.6. Of these tests, 315 (39 per cent) were FL, 255 (30 per cent) were MF, and 259 (31 per cent) were DC. From the 829 tests, there were 320 instances (39 per cent of the cases) in which *no* pursuit was elicited, and 509 instances (61 per cent of the cases) in which *some* type of pursuit was elicited. Equivalent interpolations from table 2 show that 142 different Negro infants, of whom 81 were re-tested, were given a total of 1,111 tests, the computed number of tests per subject being 7.8. Of these tests 420 (38 per cent) were FL, 350 (31 per cent) were MF, and 341 (31 per cent) were DC. Therefore, each stimulus object was used a comparable number of times in each racial group. From the 1,111 tests in the Negro group, there were 213 instances (19 per cent, compared with 39 per cent for the Whites) in which *no* pursuit was elicited, and 898 instances (81 per cent, compared with 61 per cent for the Whites) in which some type of pursuit was elicited. For all subjects at all age levels for all kinds of pursuit, then, the Negro infants excelled the Whites.

Comparative details in types of pursuit are interesting. Of the 509 instances of pursuit by the Whites, there were 241 instances (47 per cent) of Type A pursuit, 136 instances (27 per cent) of Type B, and 132 instances (26 per cent) of Type C. Of the 898 instances of pursuit by the Negroes, there were 466 instances (52 per cent) of Type A pursuit, 182 instances (20 per cent) of Type B, and 250 instances (28 per cent) of Type C. This comparison yields no discernible difference between the racial groups.

Of the 829 tests given to the Whites, 279 (34 per cent) were for H pursuit, 273 (33 per cent) for V, and 277 (33 per cent) for Cr. This is an excellent frequency distribution of test types. Of the 279 instances of H pursuit tests, there were 40 instances (14 per cent) in which *no* pursuit was elicited, and 239 instances (86 per cent) in which *some* type of pursuit was elicited. Of the 239 instances of H pursuit, there were 136 instances (57 per cent) of Type A pursuit, 58 instances (24

TABLE 1

Pursuit data from 829 tests given to 109 white newborn infants

AGE GROUPS	NUMBER INFANTS FIRST EXAMINED BY AGE GROUPS	NUMBER INFANTS RE-EXAMINED	TOTAL NUMBER EXAMINED AT EACH AGE LEVEL	NUMBER OF TESTS EACH AGE LEVEL; EACH STIMULUS OBJECT			TEST TOTALS	STIMULUS OBJECT	PURSUIT ELICITED* (FREQUENCY)												TEST TOTALS BY TYPE OF STIMULUS MOTION USED		
									Type A "Excellent"			Type B "Good"			Type C "Poor"			None					
				Flashlight, FL	Moving fingers, MF	Dark cylinder, DC			Horizontal	Vertical	Circular	Horizontal	Vertical	Circular	Horizontal	Vertical	Circular	Horizontal	Vertical	Circular	Horizontal	Vertical	Circular
Up to 5 hrs.	7	0	7	17	9	12	38	FL	2	1	0	1	0	0	1	1	0	2	4	5	6	6	5
								MF	1	1	0	1	0	0	1	1	1	0	1	2	3	3	3
								DC	2	2	0	1	1	0	1	0	1	0	1	3	4	4	4
6–12 hrs.	10	0	10	30	24	21	75	FL	3	2	1	6	2	1	2	3	1	0	2	7	11	9	10
								MF	3	3	1	3	1	1	1	1	1	1	3	5	8	8	8
								DC	4	2	1	3	2	1	0	3	1	0	0	4	7	7	7
13–24 hrs.	25	0	25	71	42	40	153	FL	7	4	0	4	4	1	6	3	5	4	10	23	21	21	29
								MF	5	3	0	3	4	0	6	2	4	1	6	8	15	15	12
								DC	5	3	0	3	5	0	6	2	3	1	5	7	15	15	10
2 days	11	12	23	26	21	19	66	FL	4	1	0	2	2	0	0	2	1	2	2	10	8	7	11
								MF	4	1	0	1	2	0	1	1	1	2	3	5	8	7	6
								DC	4	1	0	1	1	0	0	1	1	2	3	5	7	6	6
3 days	9	6	15	21	12	14	47	FL	1	1	0	1	1	1	1	1	0	4	4	6	7	7	7
								MF	0	0	0	1	1	1	2	2	0	1	1	3	4	4	4
								DC	1	0	0	2	1	1	1	1	0	1	2	4	5	4	5
4 days	7	13	20	18	24	18	60	FL	4	3	1	1	1	0	0	0	3	1	2	2	6	6	6
								MF	4	3	1	1	1	0	0	0	3	3	4	4	8	8	8
								DC	3	3	1	1	1	0	0	0	3	2	2	2	6	6	6

5 days	13	26	39	42	39	36	117	FL	7	6	0	4	4	2	1	0	2	2	4	10	14	14	14
								MF	7	7	0	3	4	2	2	1	2	1	1	9	13	13	13
								DC	6	6	0	4	3	2	0	1	2	2	2	8	12	12	12
6–8 days	20	23	43	60	60	66	186	FL	12	9	1	2	2	2	3	4	3	3	5	14	20	20	20
								MF	11	12	1	4	0	5	3	3	3	2	5	11	20	20	20
								DC	15	11	0	3	2	3	2	3	5	2	6	14	22	22	22
9–12 days	7	15	22	30	24	33	87	FL	8	2	0	1	1	1	1	0	1	0	7	8	10	10	10
								MF	6	5	0	1	2	2	1	0	2	0	1	4	8	8	8
								DC	7	5	0	0	2	2	3	0	2	1	4	7	11	11	11
Totals....	109	95	204	315	255	259	829		136	97	8	58	50	28	45	36	51	40	90	190	279	273	277

* See text for quantitative definition of each "type" of pursuit. These data are not "qualitative."

TABLE 2

Pursuit data from 1,111 tests given to 142 negro newborn infants

AGE GROUPS	NUMBER INFANTS FIRST EXAMINED BY AGE GROUPS	NUMBER INFANTS RE-EXAMINED	TOTAL NUMBER EXAMINED AT EACH AGE LEVEL	NUMBER OF TESTS EACH AGE LEVEL; EACH STIMULUS OBJECT			TEST TOTALS	STIMULUS OBJECT	PURSUIT ELICITED* (FREQUENCY)												TEST TOTALS BY TYPE OF STIMULUS MOTION USED		
									Type A "Excellent"			Type B "Good"			Type C "Poor"			None					
				Flashlight, FL	Moving fingers, MF	Dark cylinder, DC			Horizontal	Vertical	Circular	Horizontal	Vertical	Circular	Horizontal	Vertical	Circular	Horizontal	Vertical	Circular	Horizontal	Vertical	Circular
Up to 5 hrs.	3	0	3	10	6	9	25	FL	2	1	1	0	1	0	1	1	2	0	0	1	3	3	4
								MF	1	1	1	0	0	0	1	1	0	0	0	1	2	2	2
								DC	1	1	1	1	1	0	1	1	1	0	0	1	3	3	3
6–12 hrs.	10	0	10	30	27	24	81	FL	3	0	0	2	5	1	4	5	5	1	1	3	10	11	9
								MF	1	0	0	3	4	1	4	5	3	1	1	4	9	10	8
								DC	0	0	0	3	3	1	3	4	3	2	2	3	8	9	7
13–24 hrs.	34	0	34	97	87	84	268	FL	15	13	6	4	3	4	7	8	11	7	8	11	33	32	32
								MF	13	11	2	5	5	5	6	7	13	5	6	9	29	29	29
								DC	12	10	2	5	4	4	6	8	13	5	6	9	28	28	28
2 days	16	8	24	42	30	30	102	FL	10	8	6	0	1	1	0	1	1	4	4	6	14	14	14
								MF	7	4	2	0	2	1	0	1	2	3	3	5	10	10	10
								DC	7	5	3	0	1	1	0	1	1	3	3	5	10	10	10
3 days	5	10	15	15	9	9	33	FL	5	4	2	0	1	1	0	0	2	0	0	0	5	5	5
								MF	3	2	0	0	1	1	0	0	2	0	0	0	3	3	3
								DC	3	2	0	0	1	1	0	0	2	0	0	0	3	3	3
4 days	5	14	19	17	14	17	48	FL	5	5	3	0	0	0	1	1	1	0	0	1	6	6	5
								MF	4	4	1	0	1	0	1	1	1	0	0	1	5	6	3
								DC	5	5	2	0	1	0	1	1	1	0	0	1	6	7	4

5 days	33	6	39	94	92	88	274	FL	17	14	8	9	9	5	2	6	8	3	3	10	31	32	31
								MF	17	13	7	10	8	6	3	7	7	2	2	10	32	30	30
								DC	16	13	7	9	8	5	2	7	9	2	2	8	29	30	29
6–8 days	22	31	53	58	45	43	146	FL	14	11	9	2	2	2	4	3	3	1	2	5	21	18	19
								MF	11	8	5	2	1	3	1	3	3	2	2	4	16	14	15
								DC	10	9	6	1	1	2	2	3	4	1	1	3	14	14	15
9–12 days	14	12	26	57	40	37	134	FL	12	11	7	2	3	2	2	1	5	3	4	5	19	19	19
								MF	9	7	3	2	2	1	1	3	5	1	2	4	13	14	13
								DC	8	7	2	2	2	1	1	3	6	1	1	3	12	13	12
Totals....	142	81	223	420	350	341	1,111		211	169	86	62	71	49	54	82	114	47	53	113	374	375	362

* See text for quantitative definition of each type of pursuit. These data are not "qualitative."

per cent) of Type B, and 45 instances (19 per cent) of Type C. Of the 273 instances of V pursuit tests, there were 90 instances (33 per cent) in which *no* pursuit was elicited, and 183 instances (67 per cent) in which *some* type of pursuit occurred. Of these 183, 97 instances (53 per cent) were Type A, 50 instances (27 per cent) were Type B, and 36 instances (20 per cent) were Type C. Of the 277 instances of Cr pursuit tests, there were 190 instances (69 per cent, compared with 14 per cent for H, and 33 per cent for V) in which *no* pursuit was elicited, and 87 instances (31 per cent, compared with 86 per cent for H, and 67 per cent for V) in which *some* type of pursuit was elicited. Of these 87 instances of Cr pursuit, there were 8 instances (9 per cent) of Type A, 28 instances (32 per cent) of Type B, and 51 (59 per cent) of Type C.

A comparison of the data on the Negroes for the same items presents some similarities, but also striking differences. Of the 1,111 tests in the Negro group, 374 (34 per cent) were for H pursuit, 375 (34 per cent) were V, and 362 (32 per cent) were Cr. Again, a well-balanced frequency distribution. Of the 374 tests of H pursuit, there were 47 instances (13 per cent, compared with 14 per cent for Whites) in which *no* pursuit was elicited, and 327 instances (87 per cent, compared with 86 per cent for Whites), in which some type of pursuit was elicited. Of these 327 instances of H pursuit by the Negroes, 211 (65 per cent) were Type A, 62 (19 per cent) Type B, and 54 (16 per cent) Type C. The respective percentages for Whites were 57 per cent, 24 per cent, and 19 per cent. Although the Negroes here show a slightly higher proportion of Type A pursuit, the difference is not marked. Of the 375 tests for V pursuit with the Negroes, there were 53 instances (14 per cent, compared with 33 per cent for the Whites) in which no pursuit was elicited, and 322 instances (86 per cent, compared with 67 per cent for the Whites) in which *some* type of V pursuit was obtained. This difference is significant. Of these 322 instances of V pursuit by the Negroes, 169 (53 per cent) were Type A, 71 (22 per cent) were Type B, and 82 (25 per cent) were Type C. The corresponding percentages for the Whites were 53 per cent, 27 per cent, and 20 per cent. Thus, in vertical pursuit the Negroes exhibit a greater proportion of pursuit responses, even though the relative frequency of each Type is equivalent for the two groups. But in the case of circular pursuit, a marked difference is presented. Of the 362 Cr tests given the Negroes, there were 113 instances (31 per cent, compared with 69 per cent for Whites) in which *no* Cr pursuit was elicited, and 249 instances (69 per cent, compared with 31 per cent for Whites) in which some type of Cr pursuit was elicited. Of these 249 instances of Cr pursuit by the Negroes, 86 (34 per cent, compared with 9 per cent for Whites) were Type A, 49 (20 per cent, compared with 32 per cent for Whites) were Type B, and 114 (46 per cent, compared with 59 per cent for Whites) were Type C. In the case of ability to pursue an object traversing a circular path in the visual field, then, the Negroes show a striking superiority to the Whites.

It is usually maintained that infants do not pursue objects "Visually," but merely execute a sort of heliotropic orientation to light, and that, consequently, they can pursue a "light" but not ordinary objects. The present data affords an opportunity to compare the relative efficacy of the 3 stimulus objects in eliciting pursuit from the infants. Of the 829 tests given to the White infants, 315 (38 per cent) were with the flashlight, 255 (31 per cent) with the moving fingers, and 259 (31 per cent) with the dark cylinder. This is an excellent apportionment with reference to stimulus objects. In 143 (45 per cent) of the FL tests, 87 (34 per cent) of the MF tests, and 90 (35 per cent) of the DC tests, *no* pursuit was elicited. For the White infants, then, there was a slightly greater tendency for pursuit to occur in the MF and DC tests than in the FL tests, although the difference is perhaps not significant. Another question, which can be answered here, is whether the type of stimulus object influences the relative frequency of the different types of pursuit. Of the 172 instances of pursuit in the FL tests, 80 (47 per cent) were Type A, 47 (27 per cent) were Type B, and 45 (26 per cent) were Type C. Of the 168 instances of pursuit in the MF tests, 79 (47 per cent) were Type A, 44 (26 per cent) were Type B, and 45 (27 per cent) were Type C. Of the 169 instances of pursuit in the DC tests, 82 (48 per cent) were Type A, 45 (27 per cent) were Type B, and 42 (25 per cent) were Type C. There is clearly no tendency for the White infants to show better pursuit for either of the stimulus objects.

In the Negro group there were 1,111 tests, of which 420 (38 per cent) were FL, 350 (31 per cent) were MF, and 341 (31 per cent) were DC. In the FL tests there were 83 instances (20 per cent), in the MF there were 68 instances (19 per cent), and in the DC there were 62 instances (18 per cent) in which *no* pursuit was elicited. Here, again, the tendency of the Negro infants to exhibit a greater relative frequency of pursuit is shown, but the tendency is not influenced differentially by the type of stimulus object used. With respect to the quality of pursuit for the several stimulus objects, no apparent difference is shown with the Negro infants. Of the 337 instances of pursuit with FL tests, 192 (57 per cent) were Type A, 60 (18 per cent) were Type B, and 85 (25 per cent) were Type C. Of the 282 instances of pursuit with MF tests, 137 (49 per cent) were Type A, 64 (23 per cent) were Type B, and 81 (28 per cent) were Type C. Of the 279 instances of pursuit with DC tests, 137 (49 per cent) were Type A, 58 (21 per cent) were Type B, 84 (30 per cent) were Type C. Although there is a slightly greater proportion of Type A pursuit with the flashlight, the difference is probably not significant.

In any investigation centered upon the early development of responses, the question of improvement is always vital. Although the present data cannot be graphed in the manner of the conventional "learning curve," when the data are assembled as in table 3 unambiguous signs of "development," "learning," "maturation," or functional improvement are shown. For the purposes of this table, the three

age groups of tables 1 and 2 under the captions "Up to 5 hours," "6–12 hours" and "13–24 hours" have been summed and listed under "1 day;" and those designated as "2 days," "3 days," "4 days" and "5 days" have been summed and included under the single group "2–5 days" in table 3. Similarly, the groups labelled "6–8 days" and "9–12 days" in tables 1 and 2 are included in the single group "6–12 days" in table 3. Although the time distributions are not equal in this arrangement, any one familiar with the literature on infant behavior will recognize the stages as ones in which usually differentiations in behavior occur. Moreover, a fairly comparable sampling of different infants in the present data is obtained by this grouping. The former reason for the grouping is more important.

TABLE 3

Percentages of the total number of tests for each age group for each race yielding failures and each type of pursuit

AGE GROUP	TYPE OF PURSUIT								NUMBER OF TESTS GIVEN			NUMBER OF SUBJECTS		
	A		B		C		None		Both races	W	N	Both races	W	N
	W	N	W	N	W	N	W	N						
days														
1	21	26	18	18	21	33	40	23	640	266	374	89	42	47
2–5	28	48	18	19	12	16	42	17	747	290	457	194	97	97
6–12	39	53	13	12	14	19	34	16	553	273	280	144	65	79

From table 3 it is seen that of the 829 tests given to White infants, 266 (32 per cent) were with infants less than 24 hours old, 290 (35 per cent) were with infants in the 2–5 day group, and 273 (33 per cent) were with the 6–12 day group. Of the 1,111 tests given to Negroes, 374 (34 per cent) were with the 1 day group, 457 (41 per cent) were with the 2–5 day group, and 280 (25 per cent) were with the 6–12 day group. Although the relative frequencies are distributed better with the Whites, in both racial groups there is a representative number of tests given at each age level segregated in the table. Comparisons of the two groups with respect to the percentages of the total number of tests for each age group which yielded *no* pursuit and each type of pursuit affords an immediate indication of any marked tendencies in the direction of functional improvement.

An analysis of the percentage data in the table shows that (1) of the 266 tests given to White infants in the 1 day group, in 40 per cent of the cases no pursuit was elicited, in 21 per cent Type A pursuit was obtained, in 18 per cent Type B, and in 21 per cent Type C; (2) of the 374 tests given to Negroes in the 1 day group, in 23 per cent of the cases no pursuit was elicited, in 26 per cent Type A pursuit was obtained, in 18 per cent Type B, and in 33 per cent Type C; (3) of the 290 tests given to White infants in the 2–5 day group, 42 per cent yielded no pursuit, 28 per cent Type A, 18 per

cent Type B, and 12 per cent Type C; (4) of the 457 tests given to Negroes in the 2–5 day group, 17 per cent yielded no pursuit, 48 per cent Type A, 19 per cent Type B, and 16 per cent Type C; (5) of the 273 tests given to White infants in the 6–12 day group, 34 per cent yielded no pursuit, 39 per cent yielded Type A, 13 per cent Type B, and 14 per cent Type C.; (6) of the 280 tests given to Negroes in the 6–12 day group, 16 per cent yielded no pursuit, 53 per cent yielded Type A, 12 per cent Type B and 19 per cent Type C. The Negro infants exhibited a greater percentage of pursuit responses on the first day (Negro: 77 per cent; White: 60 per cent); both racial groups showed marked functional improvement as indicated by the increased percentage of Type A pursuit throughout the three age levels; the Negroes not only began at a higher level of excellence, but also showed a more rapid improvement as indicated by greater increases in the percentage of Type A pursuit (Negroes: 26 per cent, 48 per cent, 53 per cent; Whites: 21 per cent, 28 per cent, 39 per cent). These data favor the conclusion that functional development is more advanced in the Negroes at birth than in the Whites, at least with respect to the responses under consideration.

The method employed in these experiments has justified itself in yield. Numerous problems have arisen in the course of this work which require more refined methods, including photographic recording, for their solution, as well as optical instruments of precision. The most important development besides the amassing of response data has been a segregation of the optimal conditions for eliciting pursuit responses in newborn infants.

A second equally important result from this experimentation has been the development of a method and apparatus for studying visual acuity, absolute and relative sensitivity, and color vision in the newborn. Throughout this past year the writer has devoted considerable time to the testing of various optical systems for producing the following controls: the projection of a large field approximately twenty inches by thirty inches, on which forms of any *type* and *size* can be projected (lines, circles, or any irregular form); the independent variation of the *brightness* and *hue* of the field and the form, so that the form can be reduced to any relative level of brightness *above* and *below* that of the field; the maintenance of the field in a stationary condition, with the spot moving in a linear path, back and forth, across any axis of the field, or in a *circular* path of any desirable radius within the limits of the field size.

Seven different combined optical systems have been tested, and one finally developed which is entirely satisfactory. The writer has been greatly aided in the latter part of this testing of apparatus by suggestions from Dr. A. H. Pfund, Professor of Physics in the Johns Hopkins University. With reference to the control of hue, the writer is appreciative of information on the properties of Corning glass filters obtained from Dr. K. S. Gibson in the Colorimetric Section of the Bureau of Standards, Washington, D. C.

The theoretical basis for the method involves simply the assumptions (1)

that if the subject pursues a "form" across the field and returns, the movement being spatially and temporally directly correlated with the successive positions of the spot in the field, then the subject "sees" the form; (2) the seen characteristics of the form can be approximated through indirect inference from measures of acuity of absolute and relative brightness discrimination, and of hue discrimination; (3) acuity can be determined by, for example, using a line of considerable width and reducing the width to the point where pursuit is no longer elicited. This measurement would require the use of various contrasts between the field and the line, as well as various brightness levels of the field. (4) Absolute sensitivity could be determined by using a black field and raising by small steps the energy of the spot until pursuit is elicited. The critical reader can readily infer the applications to the other processes. The details of the optical system selected, and further specifications of methodology, will be assigned to a forthcoming article.

It is obvious, also, that the method is equally applicable with reference to the same functions in older infants, children, adults, as well as to animals. The method is quantitative and subject to precision measurements, and the response criteria are simple and direct, not involving round about methods, such as formation of discrimination habits, which are tremendously time-consuming and involve numerous ambiguities yielding uncertainty of results.

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A Scale of Block Constructions for Young Children[1]

MARJORY W. BAILEY

THE aim of this study was to standardize a scale which could be used as a measuring device to evaluate constructive and manipulative ability of children of nursery school and kindergarten ages. Block constructions were selected as the best approach to the problem; they provide a situation which the child can initiate himself and also one at which he can work alone or with other children. A scale of block constructions would, then, make possible study and investigation into phases of child development which heretofore have been neglected because of the lack of an adequate measuring device which would give objective, quantitative results.

REVIEW OF LITERATURE

Scaling techniques in common use at the present time have been developed as a branch from psychophysics. The first investigator to attempt to extend psychophysical methods to material that could be measured only subjectively, was Cattell. In 1903 he, using the order of merit method, ranked a group of eminent men and a group of American scientists (3).

Students of Cattell applied his methods, with variations, to the measurement of other values. Among these scales are Thorndike's scales for handwriting (8) published in 1910. Thorndike used the method of equal appearing intervals and, although his methods were somewhat crude and elementary, involving more work than necessary, they have served as a basis for the construction of many scales. His work is particularly important for the impetus it gave to the development of scaling techniques. He, however, owes considerable to Binet who was interested in scaling procedures and had published tentative scales for measuring intelligence and educational achievement prior to the derivation of the handwriting scales (7).

Thorndike recognized one of the principle limitations of the method of equal appearing intervals,—the "end effect"—which Thurstone (12) shows is due to the mechanical restrictions inherent in the method. For instance, the rater on sorting the specimens, adopts a subjective scale in which there are ten piles. But when he finds an especially good specimen, he would like to place it in a pile several steps beyond those of the scale adopted if that were possible. But this specimen must be placed in the last pile of the subjective scale he is using. This undoubtedly crowds the slightly poorer specimens toward the center piles. The same effect appears at the other

[1] From the Institute of Child Welfare of the University of Minnesota.

end of the scale. The specimens in the end piles, then, are not true representations of those piles. Thorndike (8) attempted to alleviate this error by including in his samples of handwriting artificial specimens, some better and some poorer than his real ones.

Thurstone has done more than any other individual to elaborate and refine the methods of scaling and the mathematical treatment of scaling data. His efforts have been directed toward bringing the psychophsical methods before those who are interested in measuring social values (13) (9). His experimental study of national preferences (10) illustrates the application of the psychophysical technique to the measurement of values of this type. In this study the method of paired comparison was used. This method necessitates the direct comparison of each stimulus value with every other.

Hevner (2), under the direction of Thurstone, compared the scale values of 20 specimens of handwriting from data obtained by the 3 commonly used methods of constructing psychological scales; the methods of equal appearing intervals, order of merit, and paired comparisons. The scales obtained by the last 2 methods were the same. The unit of measurement used in both of these methods is the discriminal error or "just noticeable difference" and the mathematical treatment is identical. The scale values obtained from the method of equal appearing intervals were different from those derived by the other two methods. The author concludes that in point of view of validity and reliability, the method of equal appearing intervals is inferior to the other two methods.

Although the methods of paired comparison and order of merit are not subject to the "end effect" and will undoubtedly give more reliable scale values, they are restricted in their application to fifteen or twenty stimulus values. Otherwise, the time and labor involved, both for the judges and the experimenter, is prohibitive. When the type of material to be measured requires more stimulus values, the method of equal appearing intervals must be used. The mathematical procedure involved is very simple. The resulting scale values may not be quite so accurately placed as those derived by the other methods, but if, as is often the case, very small differences in the stimulus values can not be distinguished, such a scale will be as effective as an instrument of measurement as those derived by the other methods. For this reason the method used in the present study was the method of equal appearing intervals. The procedure followed was very similar to that used by Thurstone and Chave (15) in constructing their scale for measuring attitudes toward the church.

The only scale which resembles the present one to any extent is a test of constructive ability standardized by Kelley (4) in 1916. This scale consists of a series of 40 constructions built by normal and subnormal boys. Norms were established for 8, 12, and 14 year old boys and from these, values were interpolated for a range from four years to adults. Kelley followed the method used by Thorndike (8) in his second handwriting scale except for a minor variation in weighting and averaging the various measures of difference. The set of blocks used was

somewhat similar to Tinker Toys. The complexity and cost of the materials has undoubtedly limited the use of this scale.

PROCEDURE

Individual constructions were built by 44 children. Twenty of these children were from the nursery school and 16 from the kindergarten of the Institute of Child Welfare at the University of Minnesota. The ages of the children ranged from two years, two months, to five years, nine months.

Eight older children, 6 of whom were graduates of the Institute kindergarten, were also included in the study to extend the scale far enough to make valid comparisons between children of different ages. The ages of this older group ranged from six years to nine years, eight months.

The blocks were sawed from soft wood, sanded and painted cream color. The finish was dull to reduce light reflection. There were 84 blocks in the set; the dimensions were multiples of each other, so that 2 of the smaller blocks together equalled a larger one in size. The block sizes were distributed as follows:

12 blocks 3¾ inches x 3¾ inches x 3¾ inches
12 blocks 7½ inches x 1⅞ inches x 1⅞ inches
24 blocks 3¾ inches x 3¾ inches x 1⅞ inches
24 blocks 7½ inches x 3¾ inches x 1⅞ inches
12 boards 15 inches x 3¾ inches x ¾ inch

The building was done on a platform, 48 inches x 46 inches, painted black, and mounted on heavy casters which raised the top surface 4 inches from the floor. Photographs of two different views of a construction could be obtained by turning the platform to the desired positions. Heavy blocks were slipped under the edges of the platform when building was in progress to prevent it from moving. It was solid enough so the children could sit or stand on it while working.

The blocks were stacked near one side of the platform before the child was brought into the room by the investigator. Instructions to all the children were not the same, word for word, but depended somewhat upon the age of the child. However, each child was told to build anything he chose and to use as many of the blocks as he needed, but to build on the platform so a picture could be taken of his building. No suggestions were given the child as to what to build or how to build it. If the child did not say what he was building spontaneously, he was asked when he had finished. All except 3 gave definite names to their constructions, although a few hesitated a bit before saying. In these cases the usual answer was, "a house." Of the 3 who gave no definite name, 2 responded after a few seconds that it was just a building; the other, one of the youngest children who talked very little, did not respond.

A time limit of 30 minutes was arbitrarily decided upon. This would give the children plenty of time to complete a structure if they did not keep tearing down and beginning again, and yet would not make the time prohibitive. The children did not know their time was limited and were not urged to work after they said they had finished. It was necessary to stop only 2 children. They were told, after twenty-six or twenty-seven minutes had passed to finish up quickly as it was time to go.

As soon as the child had completed his building, 2 views of it were photo-

graphed. All of the pictures were taken with the camera placed approximately the same distance from the blocks. The pictures were cut to a uniform size and the two views of each construction mounted together on cards, 5 inches by 8 inches. Two sets of the pictures were finished; on one series only the code letters appeared and on the other, the code letter with the name given to the construction by the child who built it.

The photographs were rated by 109 adults, 102 of whom were instructors and students in the University of Minnesota; 73 from the Institute of Child Welfare and 20 from the Department of Psychology. Five of the remaining 7 were college graduates. Eleven of the entire group of judges were men.

The method of equal appearing inpearing intervals was used in the construction of the scale, because there were too many items to rank by the order of merit or paired comparison methods. The error due to the "end effect" is, undoubtedly, present. It was avoided as far as possible at the upper end by including constructions built by children considerably older than the oldest kindergarten children. The values at the upper end of the scale, then, will not be needed in evaluating the constructions of the majority of nursery and kindergarten children. It is probable, also, that the constructions at the lower end of of the scale are of little importance since the poorest constructions were blocks merely piled on top of each other with no particular plan or purpose. Consequently, they represent scale values a very little above zero.

The criteria by which one picture should be judged superior or inferior to another was the next problem. There seemed to be four principle factors by which this could be determined: (1) the evidence of some plan, (2) the extent to which the plan was carried out, (3) the degree of symmetry shown in the design, and (4) care in placing the blocks accurately. As the time was too limited to obtain comparative judgments of the photographs based on each of these four factors separately, the first two were grouped for one criterion (Criterion I), and the last two for another (Criterion II). Comparison of the results obtained by these two criteria show the extent to which the judgments on them agreed.

The adults who acted as judges were divided into 2 similar groups on the basis of training; half the instructors, half the nursery school teachers, the kindergarten teachers, and so on, were in Group A and half in Group B. Individuals of Group A were given the series of photographs on which were typed the names given the constructions as well as the code letters, and nine small cards, numbered from I to IX. Instructions were typed on Cards I, V, and IX, to place on them those pictures of constructions judged to be best, average, and poorest, respectively. Printed instructions given each individual read as follows:

> These are photographs of constructions built by young children. There were 84 blocks available; the child used as many as he desired. Two views of each construction are mounted on a card. The names below the pictures are the names given the constructions by the child who built it.
>
> As a first step in devising a scale for children's block building, you are asked to compare the pictures and arrange them in

order of merit. Make your judgments on the basis of the following criteria, each of which have equal weight:

1. Plan (A complex plan is superior to a simple plan and a simple plan is superior to no plan.)
2. Achievement of the plan, i.e., the degree to which the plan is carried out.

Be careful not to let any other criteria influence your judgments.

1. Arrange the 9 small cards numbered I, II, III, IV, V, VI, VII, VIII, IX, before you in regular order. On Card I place those pictures of constructions you judge are *best*; on Card V place those pictures which you judge to be *average*; and on Card IX place those pictures which you judge to be *poorest*. On the rest of the cards arrange the specimens in accordance with the degree of excellence you judge them to have.
2. When you are through you will have 9 piles arranged in order from I, the best, to IX, the poorest.
3. Do not try to get the same number of pictures in each pile.
4. The letters below the pictures are code letters and have nothing to do with the arrangement.
5. It will be easier to arrange the pictures if you look over a number at random before you begin to arrange them.
6. When all the pictures have been placed you may want to make a few changes in our judgments. You may do this, comparing the pictures on neighboring piles as much as you like.
7. It will probably take you about 20 minutes to arrange the pictures.
8. When finished, put a rubber band around each pile including the small card with the Roman numeral.

Group B were given, individually, the set of pictures on which only the code letter appeared. Their printed directions were the same as those for Group A except the last sentence of the first paragraph referring to the names appearing below the pictures was omitted and the criteria were:

1. Symmetry of design
2. Care in placing the blocks

One week after arranging the pictures according to Criterion I and not later than two weeks individuals of Group A arranged the pictures according to Criterion II and individuals of Group B arranged them according to Criterion I. (For 87 per cent of the judges the interval between the ratings was exactly one week.)

One hundred nine adults rated the pictures. The records of 9 were eliminated; 5 arranged the pictures according to only one of the criteria, and the reports of 4 others were eliminated by the objective criteria of placing the same number of pictures in each pile or placing more than fourteen pictures in one pile. The latter standard is arbitrary, but these two criteria would tend to eliminate those who did not fully understand the directions or who did the work carelessly. There remained, then, 50 adults in Group A and 50 in Group B.

THE SCALE VALUES

A scale value and a measure of variability were determined graphically for each construction for each of the two groups of judges. Both groups of judges rated the photographs independently on each of the 2 criteria making 4 scale values for each construction. Smoothed cumulative frequency curves were drawn from the raw data and the median value for each construction was read directly from the graph. In a similar manner the 75th and the 25th percentile points were determined. The difference between them gave the interquartile range, or Q-value, which was used as a measure of the approximate variability or dispersion of the judgments of each construction.

The Q-values for the pictures which

TABLE 1

Scale values and Q-values for the pictures on the four trials

PICTURE	CRITERION I				CRITERION II			
	Group A—T1		Group B—T2		Group B—T1		Group A—T2	
	Scale value	Q	Scale value	Q	Scale value	Q	Scale value	Q
A	5.3	2.3	5.1	1.9	5.5	2.3	5.2	2.5
B	7.5	1.8	7.5	2.0	6.6	1.8	7.6	1.7
C	1.3	1.8	0.8	2.4	2.0	1.9	1.6	2.2
D	8.5	0.6	8.5	0.4	8.6	0.6	8.6	0.6
E	1.4	2.2	1.1	1.0	1.3	1.8	1.1	2.0
F	3.6	2.2	2.9	2.5	3.5	2.4	4.3	2.2
G	5.4	3.9	6.0	3.8	8.2	0.9	8.1	1.4
H	6.4	1.5	6.3	2.4	6.8	1.5	7.0	1.3
I	4.0	2.8	4.5	2.6	5.8	2.4	4.7	2.2
J	5.6	2.2	5.2	2.0	5.4	1.5	5.6	2.0
K	5.6	3.4	6.3	3.0	6.6	3.1	6.0	2.2
L	7.1	1.6	6.6	2.1	6.0	1.8	4.8	1.9
M	4.0	1.9	3.5	2.4	2.6	3.1	2.6	2.4
N	3.2	2.8	3.3	3.0	5.2	3.3	4.4	2.6
O	6.5	2.0	6.3	2.3	5.9	1.9	6.0	2.2
P	2.8	3.2	1.9	1.7	0.8	1.2	0.6	2.2
Q	4.3	3.2	3.9	2.3	3.8	2.5	4.2	2.4
R	4.7	3.5	4.5	3.1	4.6	2.9	4.1	3.1
S	4.9	1.8	3.3	1.9	3.7	1.8	3.8	2.2
T	5.2	3.4	4.7	3.4	5.2	2.6	4.8	2.6
U	7.2	2.3	7.4	2.6	3.1	3.2	5.1	4.5
V	8.3	1.2	8.4	1.0	7.6	1.8	7.9	1.6
W	3.7	2.7	3.1	2.6	3.2	1.9	3.5	2.8
X	5.4	2.9	5.0	3.1	3.8	3.4	3.8	2.4
Y	2.0	1.6	1.7	2.0	2.6	4.6	2.2	3.5
Z	2.6	2.9	2.7	2.1	2.4	3.3	3.6	3.5
aa	3.2	1.8	2.5	2.0	2.2	2.1	2.0	2.1
bb	6.9	1.4	6.4	2.1	5.3	1.7	5.8	1.9
cc	7.5	1.6	7.5	1.6	7.5	1.4	7.5	1.7
dd	6.3	2.5	5.8	2.5	4.9	2.2	4.9	2.8
ee	4.6	1.1	4.4	1.7	3.6	1.7	3.5	1.9
ff	6.4	1.7	5.9	1.9	3.8	1.9	3.9	2.3
gg	0.4	0.4	0.1	0.4	0.4	0.6	0.3	0.4
hh	1.2	2.4	1.3	1.2	1.7	1.8	1.6	1.7
ii	0.5	0.8	0.2	0.5	0.6	1.2	0.3	0.6
jj	3.9	2.9	4.5	3.6	7.9	1.8	7.0	1.9
kk	4.9	2.2	4.7	2.1	5.7	2.0	4.8	1.5
ll	5.0	1.7	4.6	2.2	3.9	1.7	3.7	1.9
mm	8.0	1.0	8.4	0.8	8.4	0.6	8.3	0.8
nn	5.7	1.8	5.9	1.9	4.0	2.0	3.3	1.8
oo	6.3	2.3	6.2	2.5	4.9	3.0	4.8	3.0
pp	7.2	1.3	6.9	1.8	5.6	2.3	5.8	2.4
qq	6.1	1.6	6.2	2.4	6.0	1.9	6.3	2.1
rr	7.3	1.5	7.1	1.9	6.9	1.7	6.4	2.1

were ranked near the upper end of the scale were determined by doubling the difference between the median and the 25th percentile; and for those at the lower end, by doubling the difference between the median and the 75th percentile. This reduced the error due to the "end effect" produced by the restrictional effect present in the method of equal appearing intervals.

Table 1 gives a summary of the scale values and Q-values for each photograph for the various trials. The table is read as follows: When Criterion I was used the scale value for Picture A was 5.3 and the Q-value, 2.3 when ranked by Group A; and 5.1 and 1.9, respectively, when ranked by Group B. This was the first trial (T1) for Group A, but as Group B had previously used Criterion II, it was their second trial (T2). When Criterion II was the basis for the judgments, the scale value for this picture was 5.5, its Q-value 2.3, when ranked by Group B, and 5.2 and 2.5, respectively, when ranked by Group A. Group A used this criterion on their second trial (T2) and Group B on their first (T1).

The approximate estimate of the reliability of the scale values for each trial was obtained by calculating the probable error of the medians by means of the formula,

$$\text{P.E.}_{\text{mdn.}} = 1.25 \frac{q}{N} \quad (1:145)$$

where q is the average quartile deviation and N is the number of judges who ranked the pictures on this trial. Substituting in this formula the obtained quartile deviation, 1.04 scale units, for Group A, Criterion I, the probable error of the median is, on the average, .18 scale units. This is .2 of 1 per cent of the entire range and indicates very good reliability. Calculation of the reliability for the other trials showed them to be equally reliable. These figures are given in table 2, column 4. In column 3 of this table the average Q-value for each trial is given. These results show that the judgments from trial to trial were very consistent.

TABLE 2

Variability and reliability of the data obtained on the various trials

GROUP	CRITERION	AVERAGE Q-VALUE*	P.E.mdn.*
A	I	2.08	0.18
B	I	2.10	0.18
A	II	2.09	0.18
B	II	2.11	0.19

* In scale units.

COMPARISON OF DATA OBTAINED ON THE DIFFERENT TRIALS

Grouping the factors which would influence the judgment of the superiority of one construction over another into 2 criteria, and having the pictures ranked on the basis of these separately, made it possible to compare the results obtained in each case. The consistency in the results of the various trials indicates that the two groups of judges were very similar. (Table 2.)

To compare the scale values obtained with each criterion, the scale values as derived from the judgments of Group A using Criterion I and of Group B using Criterion II were correlated. As calculated by the difference formula, which is a simplified method of calculating the Pearsonian correlation coefficient (6), r is .81 $\pm$ .035. This suggests

that the two criteria are highly correlated. However, there are a number of instances in which the difference between the scale values of a given construction are significantly different (1:136) as judged on the 2 criteria. Of the total 44 pictures, there are 15 in which the true differences between the scale values obtained from the judgments on the 2 criteria are significant statistically, i.e., the ratio between the obtained differences and the standard errors of these differences are more than 3.00. In addition, there are 7 pictures in which the chances are 99 in 100 that the true differences are greater than zero. Therefore, it seemed wise to construct separate scales for the two criteria.

There is a tendency for the scale values obtained when the pictures were compared on the basis of Criterion II to be slightly higher than when compared on the basis of Criterion I. The average scale value (Groups A and B combined) for the pictures on Criterion II is 4.60 and on Criterion I, 4.85. The best pictures, it will be remembered, were placed in Pile I. Also, for 12 of the group of 15 pictures in which the differences in the scale values obtained for the two criteria are greater than chance differences, and all of the group of 7, the scale value obtained for Criterion II is higher than that for Criterion I.

Next, an effort was made to determine if the ranking given a picture what Criterion I was used tended to influence the ranking of this picture on the second trial when Criterion II was used, and vice versa. This tendency often found to influence ratings is known as "halo" effect.

If such a tendency were present, then the scale values for each construction obtained on the first trial of Group A (Criterion I) would be more similar to the scale values for the same pictures obtained on the second trial of this group (Criterion II) than the respective scale values obtained by Group B on the first trial (Criterion II). The Pearsonian coefficient of correlation between the scale values obtained by Group A (Criterion I) and Group A (Criterion II) is .836 $\pm$ .030 and between those obtained by Group A (Criterion I) and Group B (Criterion II) is .81 $\pm$ .035. Likewise, the correlation between the respective scale values obtained by Group B on their first trial (Criterion II) and those obtained on the second trial of this group (Criterion I) should be higher, if halo effect influenced the ranking on the second trial, than the correlation between the scale values obtained on the first trial of Group A (Criterion I) and the first trial of Group B (Criterion II), or .81 $\pm$ .035. The coefficient of correlation between the scale values obtained by Group B (Criterion II) and Group B (Criterion I) is .856 $\pm$ .027.

These coefficients of correlation are in the right direction to suggest that positive halo effect influenced the ranking of the pictures on the second trials of both groups. However, a comparison of the differences between the obtained coefficients and the probable error of these differences (1:171) show that the differences between the coefficients are quite unreliable; being in one case .58 and in the other, 1.04.

To study further the possibility of the presence of halo effect the pictures

were divided into three groups according to whether their curves, drawn from the original data, suggested (1) the presence of halo effect on the second trial, (2) the opposite, or "negative" halo effect, or (3) no halo effect. In this last case the curves for the two trials were so close together, or crossed and recrossed so it was impossible to classify them into either of the other two groups. There were 39 in the first group, 13 in the second, and 36 in the last. Each group was very evenly divided as to criteria, i.e., there were approximately as many instances when the use of Criterion I first seemed to influence the ranking of pictures judged later on Criterion II as when the first judgments made on the basis of Criterion II seemed to influence the ranking of pictures when judged later on the basis of Criterion I. In order to determine whether or not the differences were statistically reliable, the obtained scale values for Group A and for Group B when using the same criterion were computed and compared with the standard errors of the differences (1:136). There were only 4 cases where the ratios were sufficiently large (3.00 or more) to indicate statistically reliable differences. Two of these indicated halo effect, and two indicated "negative" halo effect, and they were evenly divided as to criteria.

Although in 39 of the 88 second trials, halo effect was suggested, and in only 13 the opposite, or "negative" halo effect, there were 36 instances where neither were suggested. This means that in 56 per cent of the second trials no halo effect or "negative" halo effect was indicated. The differences between the scale values obtained on the two trials when the same criterion was used might be explained, then, by the greater familiarity with the situation on the second trial, or possibly, a slight constant difference between the two groups of judges, rather than by halo effect.

The 4 constructions involved in the trials in which there is a significant difference between the scale values obtained by the two groups when using the same criterion were disregarded, and the final scales are based on the average scale values and Q-values for the two trials. This tended to counteract any "position" effect, i.e., greater familiarity with the situation on the second trial, and to reduce any possible halo effect. It increased the number of judgments from 50 to 100 and so increased the reliability of the scale values used in the final scales from .18 (Table 2) to .13 for both criteria.

The average scale values and Q-values for Groups A and B when using the same criterion are given in table 3, which is to be read as follows: The average scale value for Picture A obtained by Group A and Group B when using Criterion I is 5.2, the average Q-value for these two trials is 2.1; the average scale value for the two groups when using Criterion II is 5.35, the average Q-value, 2.4.

THE SCALES

Photographs of constructions were selected for the scales which have low Q-values, indicating good agreement among the judges, and between which there are fairly equal intervals. These were selected from table 3 which gives the average scale values and Q-values for Groups A and B when using the same criterion.

TABLE 3

Average scale values for groups A and B when using the same criterion

PICTURE	CRITERION I		CRITERION II	
	Scale value	Q	Scale value	Q
A	5.2	2.1	5.35	2.4
B	7.5	2.4	7.1	1.75
C	1.05	1.55	1.8	2.05
D	8.5	0.5	8.6	0.6
E	1.15	1.6	1.2	1.9
F	3.25	2.35	3.9	2.3
G	5.7	3.85	8.15	1.15
H	6.35	1.95	6.9	1.4
I	4.25	2.7	5.25	2.3
J	5.4	2.1	5.5	1.75
K	5.95	3.2	6.3	2.65
L	6.85	1.85	5.4	1.85
M	3.75	2.15	2.6	2.75
N	3.25	2.9	4.8	2.95
O	6.3	2.15	5.95	2.05
P	2.35	2.45	5.95	2.05
Q	4.1	2.75	4.0	2.45
R	4.6	3.3	4.35	3.0
S	4.1	1.85	3.75	2.0
T	4.95	3.4	5.0	2.6
U	7.3	2.45	3.6	3.85
V	8.35	1.1	7.75	1.7
W	3.4	2.65	3.35	2.35
X	5.2	3.0	3.8	2.9
Y	1.95	1.8	2.4	4.05
Z	2.65	2.5	3.0	3.4
aa	2.85	1.9	2.1	2.1
bb	6.65	1.75	5.55	1.8
cc	7.5	1.6	7.5	1.55
dd	6.05	2.5	4.9	2.5
ee	4.5	1.4	3.55	1.8
ff	6.15	1.8	3.85	2.1
gg	0.25	0.4	0.35	0.5
hh	1.25	1.8	1.65	1.75
ii	0.35	0.65	0.45	0.9
jj	4.2	3.25	7.45	1.85
kk	4.8	2.15	5.25	1.75
ll	4.8	1.95	3.8	1.8
mm	8.2	0.9	8.35	0.7
nn	5.8	1.85	3.65	1.9
oo	6.25	2.4	4.85	3.0
pp	7.05	1.55	5.7	2.35
qq	6.15	2.0	6.15	2.0
rr	7.2	1.7	6.65	1.9

Scale I, derived from judgments on play and achievement of plan (Criterion I) is composed of 10 photographs, the average Q-value of which is 1.8 scale units. Picture *M* is the only one of the groups which has a Q-value of more than 2.00. The reliability, as measured by the probable error of the scale values is, on the average, .10 scale units. The average interval between the pictures is 8.9 units; the range 8.0 to 10.5 units. Beginning at the upper end of the scale (Figure 1) the intervals are in order, 8, 8, 9, 9, 10.5, 10, 10, 8.5, and 8.5 units.

The relative positions of the constructions selected for the scale are shown graphically in figure 1. The constructions are designated by the code letters which appeared on the photographs. At the left of the scale is the numerical value assigned each construction. The construction at the lower end of the scale, judged to be the poorest in plan and achievement of plan, was assigned an arbitrary value of 10, the one next higher, 20, and the next, 30, and so on, the best construction having a value of 100. Photographs of these constructions are arranged in order from No. 1, the poorest, to No. 10, the best, on the pages following. Below each construction is the name given it by the child who built it, and its assigned value.

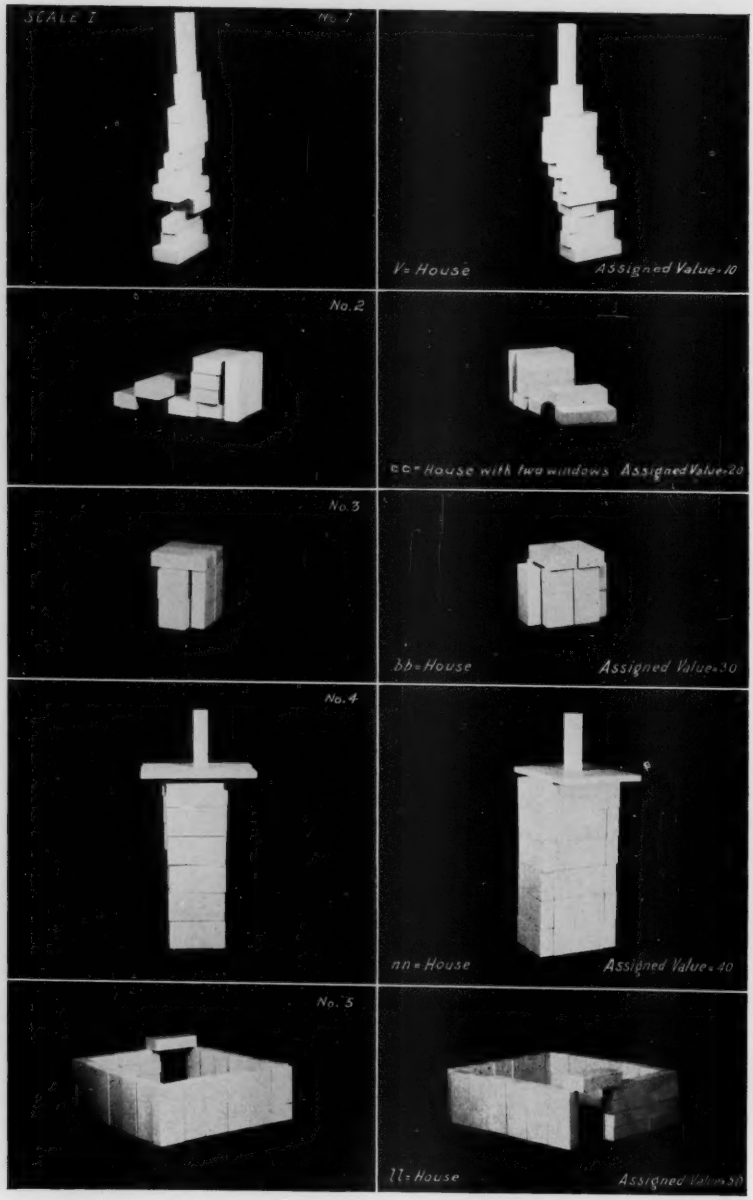
When using this scale to evaluate the plan and achievement of plan in children's constructions, a construction just as good in these respects as No. 1, or poorer, will be assigned a value of 10, a construction superior to No. 1 but no better than No. 2, will be assigned a value of 20, a construction superior to No. 2 but no better than No. 3 will be given a value of 30, and so on. A construction which is superior to No. 10 can not be rated on this scale.

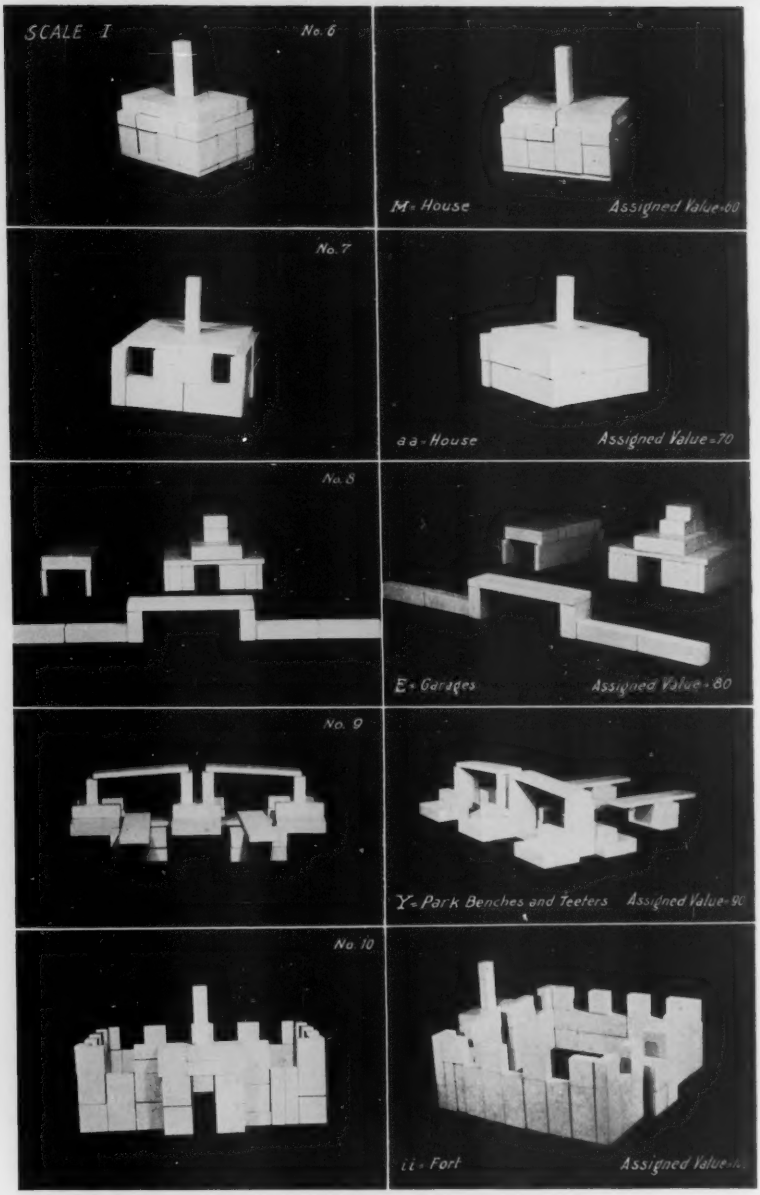
Scale II, for estimating the symmetry of design and careful, accurate work (Criterion II) has the same range as Scale I. However, photographs are omitted at two positions on this scale as there are none with low Q-values having scale values required for these positions. The intervals, beginning at the upper end of the scale (Figure 2) are 8.5, 9, (8.5 + 8.5), (8.75 + 8.75), 11, 9, and 8.5 units. The average Q-value of the pictures selected for this scale is 1.5 units. Picture *aa* is the only one of these whose Q-value is more than 2.00. The approximate reliability, determined by the probable error of the scale values, is .09 scale units.

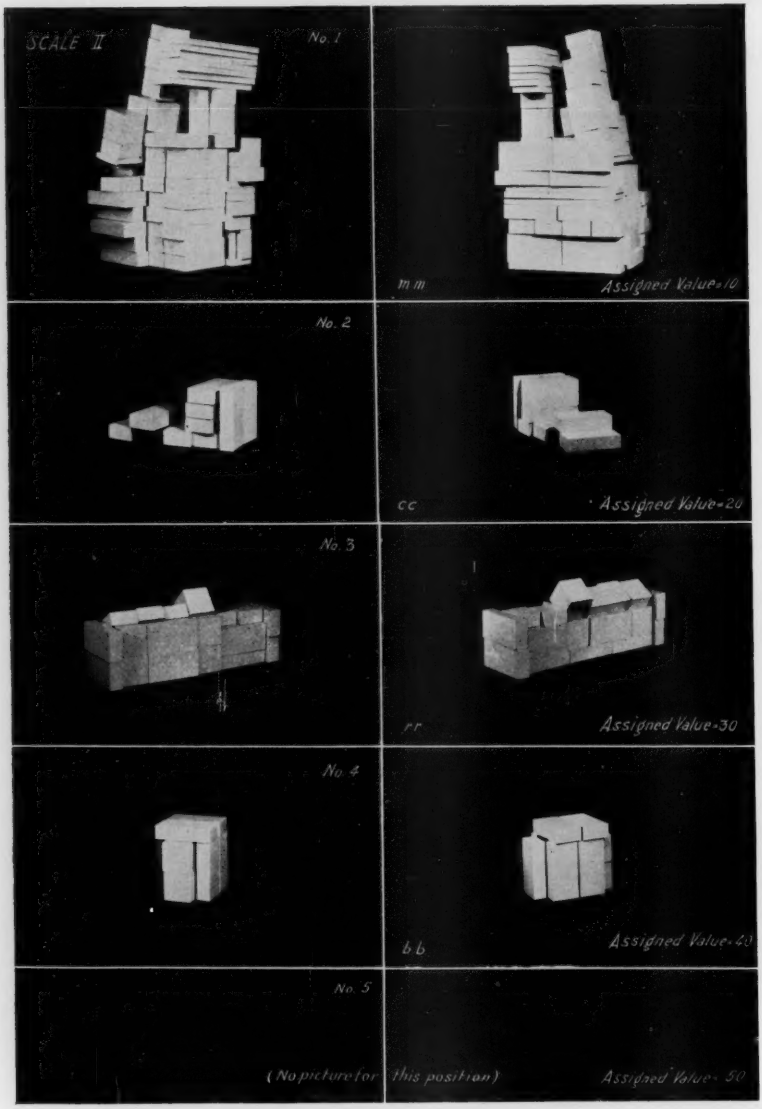
The relative positions of the constructions in this scale are shown graphically in figure 2, with the value assigned to each. The photographs of the constructions are arranged in order, from poorest to best, on the pages following those showing Scale I.

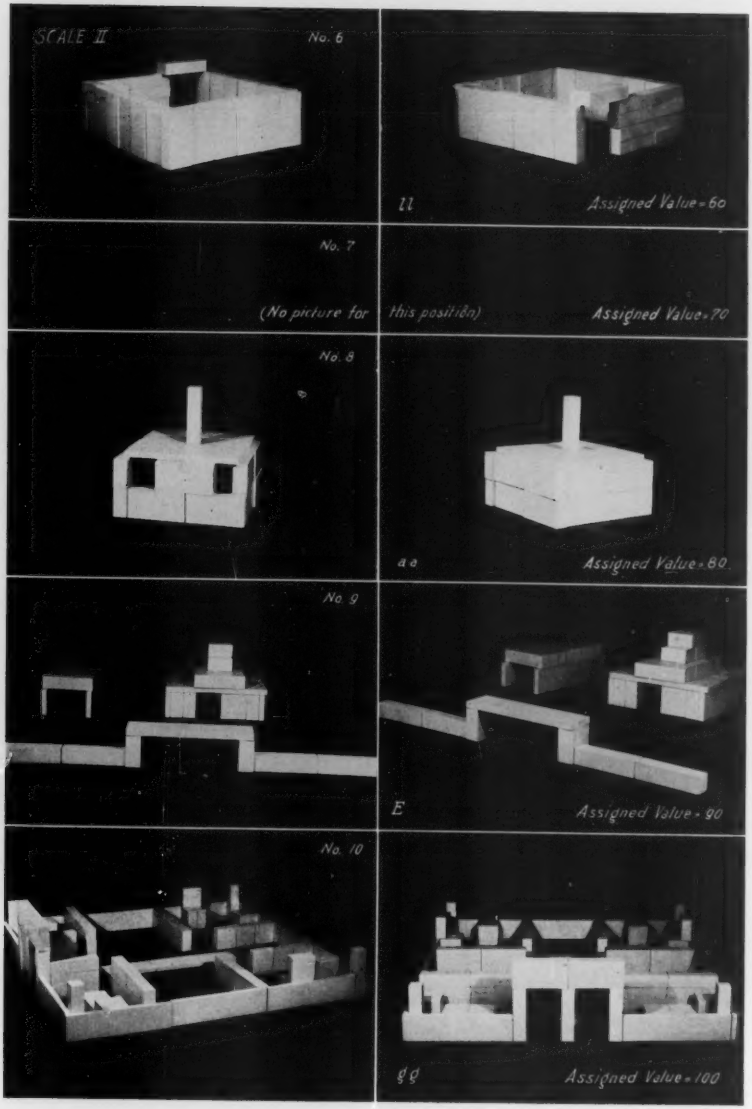
The application of this scale is the same as Scale I. For instance, if a construction is as good with respect to symmetry of design and care in placing the blocks as construction No. 1 in the scale, and no better in these respects than No. 2, it has a value of 20. The values around 50 and 70 will have to be estimated as it is these points in the scale which lack pictures of constructions with which comparisons can be made.

Scales I and II were made as similar as conveniently possible to facilitate comparison of scores obtained on the basis of the two criteria. The two


SCALE I
No. 1
V = House
Assigned Value = 10
No. 2
cc = House with two windows
Assigned Value = 20
No. 3
bb = House
Assigned Value = 30
No. 4
nn = House
Assigned Value = 40
No. 5
ll = House
Assigned Value = 50


SCALE I
No. 6
M = House
Assigned Value = 60
No. 7
a a = House
Assigned Value = 70
No. 8
E = Garages
Assigned Value = 80
No. 9
Y = Park Benches and Teeters
Assigned Value = 90
No. 10
ii = Fort


SCALE II
No. 1
m m
Assigned Value=10
No. 2
c c
Assigned Value=20
No. 3
r r
Assigned Value=30
No. 4
b b
Assigned Value=40
No. 5
(No picture for this position)
Assigned Value=50


SCALE II
No. 6
ll
Assigned Value = 60
No. 7
(No picture for this position)
Assigned Value = 70
No. 8
a a
Assigned Value = 80
No. 9
E
Assigned Value = 90
No. 10
g g
Assigned Value = 100

scores may be combined into one if a single score is more pertinent to the particular problem in which the individual using the scale is interested.

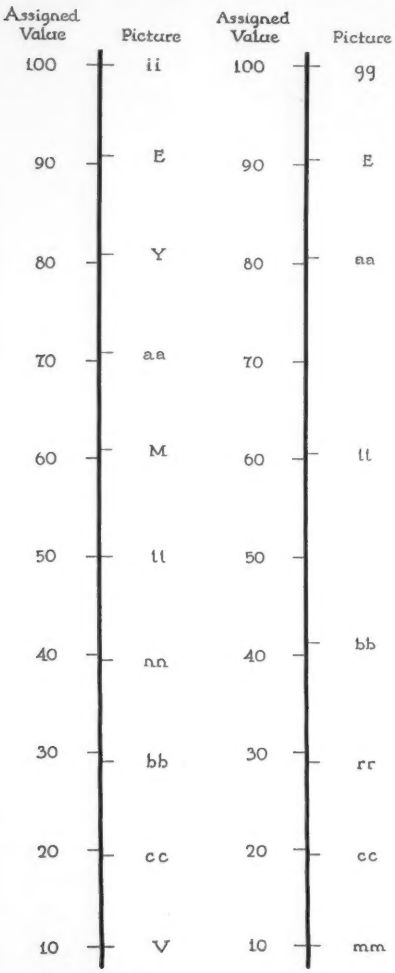


FIG. 1 FIG. 2

FIG. 1. GRAPHIC REPRESENTATION OF SERIES I
FIG. 2. GRAPHIC REPRESENTATION OF SCALE II

They may be combined in the proportions thought most expedient; if the two criteria seem equally important, then an average of the two scores can be used; if one seems more important than the other, they can be weighted accordingly. Furthermore, if an investigator is interested only in plan and achievement of plan, he can use Scale I; or if he is interested in symmetry of design and care taken in placing the blocks, Scale II.

This procedure for obtaining a single score for a construction will give more satisfactory results than if constructions are compared with either scale alone, or with a combined scale based on an arbitrary weighting of Criteria I and II. For, whenever a construction in which these criteria are not approximately equal is evaluated, the rater must decide subjectively the weight to give each of the two criteria. For example, one construction, Picture U, has a scale value of 7.3 when judged on the basis of plan and achievement of plan (Criterion I) and 3.6 when judged on the basis of symmetry of design and care in placing the blocks (Criterion II). Expressed in terms of assigned scale values for the respective criteria, 7.3 gives a value of 20 (Scale I), and 3.6 a value of 60 (Scale II). If a single estimate as to the merit of this construction be given by comparing it with a scale derived by combining the judgments on both criteria as suggested, the resulting value would, undoubtedly, lie between 20 and 60, but such judgments or evaluations would not be as consistent as those derived by evaluating the construction on the two criteria independently and combining these scores objectively.

This difficulty would appear in the evaluation of over half of the constructions if a single scale were used, as there is a difference of one scale step or more between the scores expressed in assigned scale values on Scales I and II for 61 per cent of the 44 constructions used in this study. In 16 per cent of the constructions there is a difference of 2 scale steps, in 2.3 per cent, 3 steps, and in 4.5 per cent, 4 steps.

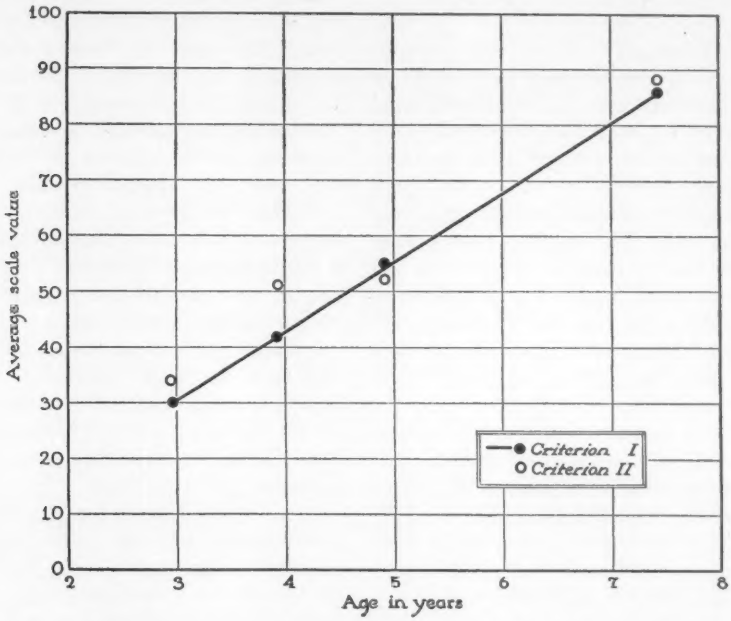


FIG. 3. GRAPHIC REPRESENTATION OF INCREASE IN SCORES WITH INCREASE IN AGE

AGE NORMS

A constructive ability test for preschool children might be standardized by establishing norms for the various ages. This would be similar to the test devised by Kelley (4) in 1916 for older boys, though the blocks used are less complex than those used by him. It would be a test which was independent of language and which presented a problem the child must initiate rather than the usual one in which the end is set for the child by the examiner.

A graph, figure 3, based on the data obtained for this study, suggests the rate of increase of the ability to plan and carry out a plan with age. The average score for the 3, 4, and 5 year olds, were plotted, as there were the most children at these ages, and also a point representing the average score for the children from 6 to 9 years inclusive. The curve drawn through

these points is fairly smooth. However the points representing the averages for the scores for these ages on Criterion II were so irregularly placed that no attempt was made to draw a curve through them (fig. 3). More data must be collected before reliable norms for either criterion can be calculated.

SUMMARY AND CONCLUSIONS

Photographs of 44 constructions built by children were rated twice by 100 adults, using the method of equal appearing intervals. On one trial the criteria were plan and achievement of plan (Criterion I) and on the other, symmetry of design and care in placing the blocks (Criterion II). Score values, the median positions in the piles, and measures of variability, the difference between the 25th and 75th percentiles, were determined graphically for each construction, and the scales constructed from these data.

The estimated reliability of the 10 photographs selected for Scale I, based on Criterion I, is .10 scale units, and for the 8 chosen for Scale II, based on Criterion II, is .09 scale units. Photographs in each scale were assigned arbitrary values of 10, 20, and so on to 100, beginning with the poorest construction in each scale.

From the results obtained in this study the following conclusions can be drawn:

1. By using the method of equal appearing intervals it was possible to develop reliable scales for measuring block constructions of young children.

2. There is a tendency for constructions to be rated near the same positions on the basis of Criterion I (plan and achievement of plan) and Criterion II (symmetry of design and care in placing the blocks) as is shown by the correlation coefficient of .81 ± .035 between the median positions of the constructions obtained on the two trials using the different criteria.

3. There are, however, sufficient differences between the median values when compared on the basis of the two criteria to warrant construction of separate scales for each criterion.

4. Some evidence of the existence of a halo effect that influenced the ranks given the constructions on the second trial when a criterion differing from that used on the first trial, was obtained.

5. Ability to plan and carry out a plan increases with age. Also as age increases it is probable that the designs made tend to be more symmetrical and that the blocks are placed more carefully.

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Pregnancy Order and Early Development[1]

HAROLD E. JONES AND HSAIO-HUNG HSAIO

THE assertion is frequently made that the later siblings of a family tend to be more intelligent than the first-born (see, for example, references 3, 9, 13, 14 and 16). Theories concerning the origin of this supposed difference have emphasized environmental factors, since there is no good reason to assume an inherited superiority of the later-born. It is known that certain differences among siblings are manifested in early development: the duration of labor is greater at the first birth, the first-born have a lower average birth weight, and they are more affected by weight loss after birth (7). These facts have suggested the possibility of a retardative influence extending into later years, and affecting mental as well as physical growth. No evidence has been brought forward, however, to indicate that these early handicaps are as a rule of more than temporary importance. With regard to other aspects of early development, data are needed as to the existence of birth order differences as well as to their significance if they are found to exist.

In the present study, the following factors have been investigated for samples ranging from approximately two hundred to one thousand pairs of siblings: the health of the mother during successive pregnancies, the incidence of prenatal casualties, the manner of delivery, the neonatal condition of the child, birth weight, duration of breast feeding, the general health of the child during the first year of life, and early locomotor and speech development.

Data were collected primarily through interview with the mothers, checked where possible from physicians' and hospital records. All comparisons are based on pregnancy order (counting abortions and miscarriages), and (except in a part of table 2) have been restricted to sibling pairs in order to avoid errors due to social selection. The sample of families has been limited to those containing two or more children. Families have also been excluded in which there was a twin birth prior to the pregnancy orders to be compared. The collection of data was from mothers in the Berkeley Survey, and from mothers attending the child welfare conferences of the Berkeley Department of Health. The 2 groups may be regarded as representative for Berkeley families with chil-

[1] For assistance in data collection, acknowledgments are due to Professor Edith Bryan of the Department of Hygiene, University of California; to Miss Agnes Covalt, Institute Nurse; and to Miss Mary G. Taylor, Chief Nurse of the Berkeley Nursing Service. The Junior author, Mr. Hsaio, is research Fellow of the China Foundation for the Promotion of Education and Culture.

dren; this is particularly true of the first group, which includes every third Berkeley birth within an eighteen months' period. In the presentation of data the 2 groups have here been combined, a procedure which appears justifiable because of the similarity of sampling and because they yield closely similar results with reference to the problems of this study.

PRENATAL CASUALTIES

Reliable information concerning abortions and miscarriages is often difficult for a field worker to obtain. In the present case, pains were taken to establish a rapport which would lead to a frank discussion of the necessary facts. In the case of the Berkeley Survey, all records were checked from

TABLE 1

Order of pregnancy and incidence of abnormal births (in terms of percentages)

PREGNANCY ORDERS COMPARED*	NUMBER OF SIBLING PAIRS	KIND OF BIRTH:			PRENATAL CASUALTIES:			
		Normal	Living prematures	Overterm	Abortions*	Miscarriages*	Non-viable prematures	Stillbirths
1	286	83.3	3.9	1.7	2.1	5.9	2.1	1.0
2		84.0	2.1	1.0	0.0	10.5	1.4	1.0
1	178	81.0	5.1	1.1	1.7	6.7	2.2	2.2
3		82.6	2.8	1.7	2.8	5.6	1.7	2.8
1	81	85.3	3.7	1.2	1.2	3.7	2.5	2.5
4		83.9	2.5	1.2	2.5	1.2	2.5	6.2
1	48	79.1	6.3	0.0	0.0	8.3	2.1	4.2
5		81.1	2.1	0.0	4.2	2.1	6.3	4.2
2	168	75.5	2.4	0.0	0.6	17.9	1.2	2.4
3		82.8	2.4	1.8	2.9	5.4	1.8	2.9
2	80	68.8	3.8	0.0	1.2	22.5	1.2	2.5
4		83.9	2.5	1.2	2.5	1.2	2.5	6.2
2	50	66.0	6.0	0.0	2.0	22.0	2.0	2.0
5		82.0	2.0	0.0	4.0	2.0	6.0	4.0
3	82	78.0	2.4	1.2	4.9	9.9	1.2	2.4
4		83.1	2.4	1.2	2.4	2.4	2.4	6.1
3	50	78.0	2.0	2.0	4.0	10.0	2.0	2.0
5		82.0	2.0	0.0	4.0	2.0	6.0	4.0
4	48	83.3	2.1	0.0	4.2	0.0	2.1	8.4
5		83.3	2.1	0.0	4.2	0.0	6.2	4.2

* Miscarriages were defined as foetuses expelled in the 4th, 5th or 6th month; abortions, as foetuses expelled before the 4th month.

data in the offices of the attending physicians. In spite of the care taken with respect to the various schedules, it is possible that in a few cases information was withheld, particularly with regard to abortions. So far as the writers are aware, however, there is no reason to suppose that for any given category such information would be withheld in differing degrees in the various pregnancy orders.

From table 1 it may be noted that the incidence of normal births is practically the same, in the first compared with later pregnancies. In the remaining categories of the table, differences are too small to be statistically reliable or practically significant; however, it may be noted that in conformity with other studies, the percentage of prematures is obtained as slightly higher for the first pregnancy, in all comparisons; there are also consistently more abortions and miscarriages in the first pregnancy, in comparison with the third, fourth and fifth pregnancies. A fact of some incidental interest is the high incidence of miscarriages in the second pregnancy; this is reliably greater than in the third, fourth or fifth.

An attempt has been made to determine whether these differences are influenced by the age of the mother, or by the interval between pregnancies. The mean ages range from 23.1 years (age at first pregnancy, among mothers having five pregnancies) to 31.5 years (age at fifth pregnancy). The average intervals between successive pregnancies range from 2.53 to 2.64 years. It has been considered unnecessary to present the detailed tables dealing with this material; an examination of these tables, which are on file at the Institute of Child Welfare, indicates that the birth order differences in prenatal casualty cannot be attributed to differences in age or in pregnancy interval.

Taking all prenatal casualties together, the unweighted average is 13.7 per cent for the second pregnancy, and between 6 and 8 per cent for each of the other pregnancies. At least two hypotheses may be offered to account for this: (1) In the pregnancy following the first pregnancy, physiological conditions may be more frequently unfavorable to normal gestation. (2) Interference with the foetus may be more common in the second pregnancy. In later pregnancies, a greater tendency may exist for abortions induced at an early stage, and probably less often recorded than miscarriages. Direct evidence on these points would be highly desirable. There is a slight possibility that the differential pre-natal mortality is selective with reference to biological factors which are correlated with normality in later development; the consequence may be favorable for the average status of the surviving members of the second birth order, although it could hardly be expected to have a very perceptible net effect.

It may be noted that in this material there is an unreliable yet fairly consistent tendency for abortions to increase in the later pregnancies. The percentage of nonviable prematures and of stillbirths seems to show a similar tendency to increase, although such a finding would not be in agreement with Ansell (2) and Pearson (10), who report more stillbirths in earlier pregnancies.

MANNER OF DELIVERY

Numerous writers have called attention to the greater duration of labor among primiparae, and the resulting possibilities for greater birth trauma. Cadre (4) has reported a greater tendency to cranial compression in first-born, resulting in overlapping of the parietal bones; there appears to be in this respect a possible source of developmental damage, through intracranial hemorrhage and other mishaps at delivery. In view of this, it appears desirable to compare the pregnancy orders with reference to circumnatal conditions.

In studying the manner of delivery we have excluded the following types of families: those in which there have occurred abortions, miscarriages, or premature births among either the first- or second-born, and those in which a description is lacking of either of the first two deliveries. The data have been classified into five categories: spontaneous delivery, delivery by manipulation, instrumental delivery, delivery by the use of drugs, and Caesarian delivery. The results which are presented in table 2 clearly show that instrumental delivery occurs most frequently among the first-born, while the use of drugs is more common in the higher pregnancy orders. It may be noted that in table 2 the samplings of successive pregnancy order are strictly comparable (on the basis of sibships) only for the first two orders.

TABLE 2

Percentages of each type of delivery, by order of pregnancy

ORDER OF PREGNANCY	TOTAL NUMBER OF CASES	MANNER OF DELIVERY				
		Spontaneous	Manipulation	Instrumental	Drugs	Caesarian
		per cent	*per cent*	*per cent*	*per cent*	*per cent*
1	238	74.0	1.2	18.5	4.2	2.1
2	238	59.3	3.8	8.4	26.0	2.5
3	116	56.2	0.9	4.1	37.1	1.7
4	52	77.0	1.9	3.8	17.3	0.0
5	39	71.9	0.0	0.0	25.6	2.5

Elderton (5) has stated that the percentage of abnormal confinements drops from 22 per cent for the first-born to 14 per cent for the second-born and 8 per cent for the third- and fourth-born. These percentages are close to the figures in the present investigation, if our percentages for "instrumental delivery," "manipulation," and "Caesarian" are combined. It must be pointed out, however, that in the present material it is only in the case of instrumental delivery that an unfavorable weighting occurs for the first-born. That this is not necessarily nor even typically a handicapping factor (except in the case of high forceps deliveries), is indicated in the extensive data of Wetterdal (15), who found that among children surviving into school age there was no relationship between their physical robustness at that time, and instrumental or non-instrumental birth.

Further evidence bearing on this issue was obtained from mothers' testimony concerning neonatal condition. The nurses interviewing the mothers were instructed to inquire: "Were there any differences in the condition of your babies during the first few days after birth?" Specific inquiries were made concerning possible differences in birth shock, robustness, weight loss and weight recovery after birth, and other relevant items. In the case of the Berkeley Survey mothers, additional information was obtained from the physicians' and hospital records. A total of 288 paired comparisons are available, for the first three pregnancy orders. In 80 per cent of the cases no differences could be established; in 6 per cent the data are favorable to the earlier-born, and in 14 per cent to the later-born. While no great weight should be attached to evidence

of this character, it appears to be incompatible with a belief in a marked neonatal handicap of the earlier-born.

BIRTH WEIGHT

In the present sample there are available 175 families in which the birth weights are known for the first- and second-born (excluding prematures). The first-born average 7.85 pounds, with an S.D. of 1.28; the second-born average 7.95, with an S.D. of 1.15. This difference in favor of the later-born are heavier, and in 52 per cent the later-born are heavier. It is apparent from the foregoing that this sample is similar to others in which a slight birth weight difference has been found in relation to pregnancy order (6). This, however, is not necessarily evidence of biological inferiority, since it could be due to a slightly shorter pregnancy (the first pregnancy may be expected to include not only more children diagnosed as prematures, but also

TABLE 3

Correlations between age of mother and birth weight of child

SEX	FIRST PREGNANCY ORDER		SECOND PREGNANCY ORDER	
	N	r	N	r
Male	97	$-.22 \pm .06$	89	$-.30 \pm .06$
Female	78	$-.16 \pm .07$	86	$-.12 \pm .07$

TABLE 4

Order of pregnancy and duration of breast feeding, in months

PREGNANCY ORDER	N	MEAN	MEDIAN	S.D.
1	167	$5.95 \pm .25$	$5.04 \pm .31$	$4.74 \pm .18$
2	167	$5.16 \pm .24$	$4.46 \pm .30$	$4.63 \pm .17$
3	74	$5.97 \pm .38$	$5.25 \pm .47$	$4.84 \pm .27$

second child would be slightly increased if allowance were made for two factors: the slightly larger proportion of males occurring in this sample among the first-born, and a slight negative correlation between the age of the mother and the birth weight of the child (table 3).

When all of the sibling pairs in the first five pregnancy orders are considered, birth weight data are available for 639 pairs of earlier-vs. later-born siblings. In 9 per cent of these pairs the recorded birth weights are the same; in 39 per cent the earlier-born more children who are born between the zone of prematurity and normal term).

On one other point, it is found that this group shows a normal relationship as to birth weight; the correlation between the first and second sibs (double entry) is $.50 \pm .038$, indicating a degree of similarity at birth which is the same as that exhibited in many physical and mental traits at a later age.

BREAST FEEDING

Schlesinger (11) has reported that the first-born have "less participation

in the blessings of the mother's breast," implying that this deficiency may exert a retardative effect. The material which we have used for the study of the duration of breast feeding includes 167 families giving information concerning both of the first two children. Data are also available for 74 children in the third pregnancy order. The results, as shown in table 4, indicate the lack of any significant differences between the three orders. The standard deviations for each order indicate a wide variability in the duration of breast feeding.

MOTHER'S HEALTH DURING PREGNANCY

Information on this point was obtained (in the case of the Berkeley Survey mothers) through the physicians' records, and also in all cases through interviews with the mothers. The question was asked, "How was your health during each pregnancy—do you recall any differences for the different children?" The mother might reply, for example, that she felt about the same for James and Mary, but had an illness of three weeks' duration in the case of Henry. A detailed statement was taken, and on the basis of all available information the successive pregnancy orders were paired as involving "about the same" or "perceptibly different" health in the mother. This is of course a very crude method of determination, and subject to a variety of errors in individual cases; it is, however, probably adequate for a preliminary comparison of groups. Among 310 pairs in the first three pregnancies, mother's health was judged "about the same" in 64 per cent; in 19 per cent it was favorable to the earlier pregnancy and in 17 per cent in the later.

The chief conclusion from this section is a negative one; those writers who entertain a belief in the handicapping of the earlier born, and who trace this handicapping to greater difficulties of pregnancy, can find no support in the present evidence. Considering this material merely with reference to its "psychological" validity, it is here apparent that, in retrospect at least, mothers in general do not regard the first or earlier pregnancy as more severe than a later one. Contrary views concerning first pregnancy, occasionally noted in the literature, are no doubt influenced by data from single-pregnancy families.

GENERAL HEALTH OF THE CHILD DURING FIRST YEAR

A similar procedure was used in comparing pairs of siblings as to health during the first year, and with very similar results. Among 274 pairs in the first three pregnancy orders, differences in health were reported in 35 per cent of the cases: 18 per cent favoring the later born and 17 per cent the earlier born.

AGE OF WALKING

As an additional criterion of physical development, the mothers were asked, "Did your children show any differences in the time at which they learned to walk?" Ability to walk was defined as the ability to take three or more steps without aid or support. The mother's recollection of the month of beginning to walk is of course not very trustworthy. It is probable, however, that she can make compari-

sons between her children with less error than in giving an absolute date. As the children of the Berkeley Survey were for the most part below the age of beginning to walk at the time when these records were taken, the data are limited to 191 pairs in the first three birth orders. Of these, 28 per cent of the pairs are recorded as "learning to walk at the same ages." This is a much smaller percentage of like performance or like condition, than was found in the case of the preceding developmental categories. Of the 72 per cent of the pairs presenting differences, these differences were in favor of the earlier-born as often as the later-born. In the comparison of the first and second birth orders, a slight but unreliable difference was recorded in favor of the first-born (table 5).

TABLE 5

Age at beginning to walk: Percentage of sibling pairs in each of three categories

	BIRTH ORDERS		
	1 vs. 2 N = 106	1 vs. 3 N = 43	2 vs. 3 N = 42
Elder sib more precocious	39	37	27
Younger sib more precocious	34	42	36
No birth-order difference	27	21	38

TABLE 6

Age at beginning to talk: Percentage of sibling pairs in each of three categories

	BIRTH ORDERS		
	1 vs. 2 N = 102	1 vs. 3 N = 37	2 vs. 3 N = 32
Elder sib more precocious	33	27	34
Younger sib more precocious	34	40	32
No birth-order difference	33	33	34

READINESS IN LEARNING TO TALK

Data on "learning to talk" are available for 171 sibling pairs. Each mother was asked to compare her children as to early differences in language development. The criterion here was the readiness of acquiring a functional language; the possession of one or two words at an exceptionally early age was not designated as significant. Table 6 indicates no systematic tendency, in the mothers' reports, for the later-born to be superior.

From these results, no support can be obtained for the belief that later-born children are favored in the stimulation of language. This negative conclusion, while not in agreement with some earlier reports, is confirmatory of studies by M. E. Smith (12) and by Abt, Adler and Bartelme (1).

SUMMARY AND CONCLUSION

Investigators who have reported an inferiority of the first-born in intelligence or in other psychological traits have in some instances attributed their findings to a prenatal or neonatal handicap, or to unfavorable developmental conditions during the first year.

Since average birth order differences are not attributable to heredity, their existence has been taken as evidence of the importance of environmental influences. Recent studies, however, have tended to cast doubt upon the importance of average differences between the birth orders; in the case of intelligence, scaling errors in the instruments of measurement have been found to be responsible for many of the reported effects of birth order (6, 7, 8). The present study is concerned directly with environmental differences as indicated by data on prenatal casualties, manner of delivery, breast feeding, mother's health during pregnancy, and general health of the child during first year; and with early developmental characteristics, as represented by birth weight and age of walking and of talking.

In the above categories the results were negative as to average birth order differences which could be regarded as having any significance for later development. In individual cases, important effects may derive from factors associated with order of birth, but these effects are not distributed so as to produce on the average a favorable or unfavorable environmental weighting of any particular birth rank.

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Experimental Studies of the Newborn

ELIZABETH B. HURLOCK

BECAUSE of the interest that accompanies the arrival of an infant, one might justly assume that numberless experimental studies of his birth equipment have been made. This, however, is not the case. It has been only in recent years that studies of this sort have been made, and these have emphasized only a few aspects of the birth equipment. The major emphasis has been on the study of the physical and sensory development, with relatively little emphasis on the study of mental and emotional development.

One of the few important pioneer studies of the newborn was made by Preyer (52) in 1881. In his "Mind of the Child," Preyer reports from observational studies of his own child what reflexes were present at birth. Other important biographical studies which reported the development of the newborn were made by Tiedemann (69), Darwin (13), Shinn (62) and Moore (42). These early biographical studies, made by parents or near relatives, were studies of individual babies and thus no general conclusions can be drawn from them.

The first experimental investigation of the newborn, using a group of subjects, was made by Kussmaul (34) in Germany in 1859. This investigation included a study of the sensory equipment at birth and an inventory of sensory reactions. Similar studies, following closely along the same lines, were made by Genzmer (19) in 1873, by Kroner (33) in 1882 and by Peterson and Rainey (47) in America in 1910.

In recent years, as an outgrowth of animal psychology, a number of observational studies of the behavior and emotional reactions of the newborn have been made. Watson (73, 74), at the Phipps Clinic of Johns Hopkins Hospital in Baltimore, made inventories of the reflexes, the "instinctive equipment" and the emotions of the newborn. The Shermans (59, 60, 61) and Blanton (4) have made studies similar to that of Watson.

Continuous observations, with minute to minute records of behavior, are the latest development in the study of the newborn. C. Bühler (7) in Vienna, Pratt, Nelson and Sun (51), Weiss (76) and Irwin (24, 25, 26) in America have all employed this technique. To increase the accuracy of the study, Weiss and Irwin, at Ohio State University, have used an "experimental cabinet," sound proof, with controlled lighting and regulated temperature. A stabilimeter platform records all gross bodily movements.

THE PERIOD OF THE NEWBORN

The period of the newborn, or the "neonate" ("neo" from the Greek, "new," "nate" from the Latin verb

"nascor," "to be born") extends over the first ten or fourteen days of life. According to medical standards, the period of the newborn lasts until the navel heals, and this occurs at approximately the age of ten days. Psychologically, the period of the newborn is a "plateau" in development, a period during which no development takes place. It is during this time that the human being becomes adjusted to his new environment, an environment so different from that of the mother's womb, that approximately ten days or two weeks are required to complete this adjustment. When the adjustment has been made, the newborn begins to gain in weight and an improvement in motor coördination is apparent. These signs mark the end of the period of the newborn and the beginning of babyhood.

EXPERIMENTAL STUDIES OF BIRTH EQUIPMENT

In summarizing the experimental studies of the birth equipment of the human being, the following subdivisions will be used as a means of classifying the material available on this subject: (*a*) Sleep; (*b*) Activities; (*c*) Vocalization; (*d*) Sensory Equipment; (*e*) Emotions; (*f*) Learning; (*g*) Consciousness; (*h*) Testing the Newborn.

Sleep of the newborn

The newborn sleeps from fifteen to twenty hours daily, as compared with eight hours or less in the case of the adult. Unlike the adult's sleep, the sleep of the newborn is broken by short waking periods which occur on the average of every two hours. At night, the waking periods are fewer and shorter than they are during the day.

The percentage of sleeping time in 24 hours has been investigated by Bühler (7) and by Pratt, Nelson and Sun (51). Using 5 infants for observations, Bühler reported that 89 per cent of the 24 hours was spent in sleep as compared with 55 per cent at the age of one year. The longest period of uninterrupted sleep during the infancy period was 220 minutes. Pratt, Nelson and Sun making observations on larger numbers of infants for 15 minute periods, reported that on the day of birth, 64 per cent of the periods studied were spent in sleep; on the first day, 84 per cent; and on the fourth day, 68 per cent.

The sleeping position of the newborn has been investigated by several observers. Bühler (7) shows its likeness to that of the embryo, and describes it as follows: "The fists lie slightly bent near the head. The knees are somewhat stretched, the soles of the feet, at least the big toes, lie one on the other. If perchance a finger, a hand, or a wrist, fall in the child's mouth, it is sucked."

Shirley's (63) observations of 25 newborn infants indicated that the commonest sleep posture is on the back with the knees flexed, the arms flexed at the elbow and the upper arm close to the infant's side. The hands are placed at the shoulder level, with the palms facing outward. Irwin's (25) observations recorded a similar posture. He added to the above description the fact that the head is turned to the right or left.

The characteristic method of falling asleep and awakening has also been observed by Bühler (7) and described as follows: "The newborn child twitches in that moment when he falls

asleep. . . . . Awakening, the newborn child throws his head backward, stretches his arms and body."

Activities of the newborn

During its prenatal environment, the human infant is not motionless, but from time to time exhibits definite movements. From the moment of birth, activity of an imperfect, uncoordinated, random sort is apparent during the sleeping as well as the waking hours. Even in the case of prematurely born infants, activity similar to that of the full-term infant occurs. Minkowski (37, 38), in his study of 17 two to five months old foetuses, removed from the mother's body by Caesarian operations, found that specific reflexes could be obtained by touching the eyelid, the lower lip and by striking the patellar tendon. Brushing the skin of the trunk and limbs and shifting the body position led to non-specific movements. Random, diffuse movements of the head, trunk and limbs were also apparent.

Experimental studies of the different activities of the normal, full-term infant may, for convenience, be arbitrarily classified as follows: (1) *Reactions*, or activities aroused by stimuli from without, and (2) *Spontaneous Activities*, which arise from some inner motive, in the absence of specific external stimuli.

Reaction. Many investigations by physiologists and psychologists have been made to determine what reflexes and general responses to environmental stimuli are present at birth. A summary of the outstanding reflexes consists of the following: chin, plantar, cremasteric, corneal, pharyngeal, pupillary, knee jerk, Achilles tendon, Babinski, lip, tongue, flexion, grasping (Darwinian), blinking, patellar, digestive, breathing, heart action, etc.

The first reflexes to make their appearance are those which have distinct survival value. The patellar, pupillary and digestive reflexes are ready to function several months before birth as may be seen in the case of the prematurely born. Heart action, sneezing, crying and breathing all begin at birth.

Two of the reflexes present at birth, the Babinski (fanning of the toes) and the Darwinian (grasping) are present at birth but disappear later. The Babinski reflex is usually gone by the age of six months, and in normal babies, is never present after the age of two years. Bryan (6), using 9 Mexican, 23 negro and 68 white infants, found that in not one of these cases was the reflex present on the first day. Seventeen of the white infants displayed it on the second day and 13 on the third day. The development was much later in the case of the negro infants. The first appearance was on the eighth day, followed by another case on the ninth day. Not one of the remaining 21 cases appeared during the infancy period. This reflex was found to occur earlier when the infant was asleep than when awake and earlier in the left than in the right foot.

The Darwinian or grasping reflex is distinctly weakened by the end of the first month and normally disappears completely by the fourth month. Bryan (6) found the grasping reflex to be generally present among the newborn, and it persisted during the entire infancy period. In only a few of the

cases, however, was the infant able to support the body weight. In many instances, the grasp was strong enough to lift the head and shoulders from the table.

Angelis (1) found that the race, age and sex factors had no influence on the reflex action of the newborn. Burr (10), studying 69 infants, 27 of whom were negro, likewise reported that there were no race differences in reflex action.

In an infant born with the cerebrum absent, Trommer (71) found that the Babinski, labyrinthine and neck reflexes were absent, as well as reflex responses to light, smell, taste, sound and warmth. On the other hand, the plantar, grasping and suspension reflexes were present. From an examination of 69 infants, Burr (10) concluded that the absence of some or all of the deep and superficial reflexes, such as the Achilles, knee, plantar, abdominal or chin, or the unequal development of the reflexes on the two sides of the body, indicate a pathological condition.

General responses, involving a portion or all of the body are present at birth in addition to the specific reflex responses already recorded. The most common of these which have been subjected to experimental investigations are:

1. Feeding responses (sucking, swallowing, tongue, cheek and lip movements). Ripin (56) in her observation of 60 newborn infants, found that feeding reactions were elicited only by direct contact in the mouth or cheek region. Popper (49) studying 70 infants ranging in age from one-half hour to ten days, found that sucking movements were initiated when the lips were touched, and in some instances, the head was turned toward the side of the touch. A general restlessness involving the opening of the mouth, snapping of the jaws and turning the head, followed a touching of the cheek, instead of sucking movements. Koffka (32) states that the infant's sucking occurs when *any* object, such as a finger, is placed in the mouth. When the infant has had sufficient nourishment, he refuses to suck on the nipple, even when it is placed in his mouth.

Sucking has been investigated by Jensen (30). The most vigorous sucks are made by hungry, awake infants, but become disorganized as the infant is fed. Swallowing accompanies sucking of milk, but does not accompany sucking air.

2. Sucking fingers. Blanton (4) noticed this form of reaction as early as twenty minutes after birth.

3. Tears. Blanton (4) found that occasionally tears are in the eyes at birth. The normal time for shedding of tears to appear first, however, is from the 13th to the 16th day after birth.

4. Slight lifting of the head. Bryan (6) has reported that of 97 infants studied, 11 could lift the head and shoulders on the first day, 31 on the second, and only 4 were unsuccessful by the tenth day.

5. Hiccoughing. According to Blanton (4) this reaction is well developed when the infant is 6 hours old.

6. Left foot movements of which kicking is the most pronounced. Shirley (63) has reported that kicking is not only strong, but is usually alternate and rhythmical.

7. Turning movements. Blanton

(4) and Watson (73) report that almost from birth, infants can turn over from face to back. Shirley (63) found that in 6 out of the 25 infants she observed, turning from back to side occurred between the ages of one and eleven days.

8. Turning of the head. Shirley (63) reports that when the infant is awake, the head is turned freely from right to left. Accompanying this is generally random kicking and squirming, especially during crying.

9. Visual fixation on light. Taylor (67) found that in 23 out of 75 healthy infants studied by him there was evidence of the ability to focus the eyes during the first day of life. Sherman (61) has reported that at the age of 6 hours, more than half of the eye movements are uncoördinated. A rapid decrease in incoördination occurred, ranging from an average of 37.5 per cent at 6 hours to 13 per cent at 10–24 hours of age, and 10 per cent at 50 hours.

10. Prancing. When supported at the axillae, McGraw (36) found that many newborn infants made walking or "prancing steps." A general flaccidity of the entire body is apparent, with the legs flexing and turning under the body. Bauer (2) refers to a "creeping phenomenon" in the newborn. When the infant is given something to kick against, when placed on his stomach, vigorous kicking pushes him forward a few inches. The stimulus responsible for arousing this instinctive act is, according to Bauer, pressure on the soles of the feet.

Spontaneous activities. Spontaneous activities of the newborn include all movements in which there is no specific external stimulus which is responsible for producing the activities. These activities are less numerous than the reactions of the reflex or general response types.

Gesell (20) in observations of the newborn, has noted the following random, spontaneous activities:

1. Rhythmic tensing movements of the eyelids.
2. Slight frown and corrugation of the brow.
3. Rhythmic dilation and partial closure of the nostrils.
4. Rhythmic mouthing movements.
5. Rotating movements of the hands.
6. Expulsive sounds, such as "eh, eh, eh."

Spontaneous eye movements, consisting of voluntary opening of the eyes and rolling of the eye balls from side to side were found by Bryan (6) in the case of healthy infants immediately following birth. Eye coördination, on the other hand, existed in only a few of the cases studied by her.

C. Bühler (7) has divided the activities of the newborn into three classes: "positive reactions," or reactons which are beneficial to the organism; "negative reactions," to harmful influences, and, "spontaneous reactions." In the case of the former, she includes such reactions as nourishment and grasping. As illustrations of negative reactions, she gives flight and defense movements, crying and screaming.

The time spent in each of these forms of activity during the course of a day, in the first month of life is as follows:

	percent
Sleep and dozing	88.7
Negative reactions	7.0
Positive reactions	3.3
Spontaneous reactions	1.0
Total	100.0

Pratt, Nelson and Sun (51) in their 5, 10 and 15 minute observations of 25 healthy infants summarize the following facts in relation to infant activity:

1. Even when no external stimuli are present, the infant who is asleep moves 21 per cent of the time; when awake, 42 per cent of the time.

2. Wet infants are active 30 per cent of the time as compared with 21 per cent of the time when they are dry.

3. In the morning, infants are active 45 per cent of the time as contrasted with 55 per cent of the time in the afternoon.

4. After feeding, infants are very quiet. With the approach of feeding time, they are restless and "fussy."

Continuous observations made by Irwin (25) of 4 infants during the first 10 days of life revealed that the average percentage of movements for the head was 4 per cent; for the body, 28 per cent; for the arms, 21 per cent; for the legs, 30 per cent and 17 per cent for sounds.

Mass activity of the newborn, which involves the whole organism, was found by Irwin and Weiss (27) to be most pronounced. Just before nursing and between 10:00 p.m. and 6:00 a.m., Gatewood and Weiss (18) using 78 newborn infants as subjects, found the percentage of specific movements to be as follows: body movements, 41.55 per cent; head movements, 5.12 per cent; arm movements, 15.15 per cent; leg movements, 30.25 per cent; sounds, 7.93 per cent.

Sex and race differences in the activities of the infant have been studied by Gatewood and Weiss (18) in the case of 42 white and 36 negro infants. The negro males made 1.85 movements per minute as contrasted with 2.08 of the white males; negro females, 2.17 as contrasted with 2.09 of the white females. This indicates that negro infants are less active than white, while male infants are less active than female. Pratt (51) using the stabilimeter to obtain objective records of activity, has reported that there are no statistically significant differences in the general activity of male and female infants.

Vocalization of the newborn

The birth cry, which appears at birth or shortly afterwards, marks the beginning of speech. At first, this is purely reflex and is called forth by the contact of the newborn with air, or by plunging it into cold water. The purpose of the birth cry, from a physiological point of view, is to supply the blood with fresh oxygen and to inflate the lungs, so as to make breathing possible.

Many interpretations and descriptions of the birth cry have been given. Kant first referred to it as "a cry of wrath at the catastrophe of birth." Darwin (13) in 1877 stated that "crying is of course uttered in an instinctive manner, but seems to show that there is suffering." Fenton (15) refers to crying as "reflex in character; when the vocal muscles chance to contract, sounds arise, but they are uttered without intent, and are not to be thought of as indicating particular meanings." Blanton (4) had an opportunity to study one infant without a cerebrum and reported that it did *not* cry out at birth. During the 10 days it lived, only 4 cries were heard and these took place during an examination of the skull.

Blanton (4) found that the birth

cry takes place during the birth process, when the gradual displacement of the placenta makes the connection between mother and infant less efficient. This cry, she found, is rarely spontaneous, as the technique of delivery is such as to stimulate it at once.

Many writers refer to differentiation of tones in the infant's crying. Bühler (7) describes the cries as being of two sorts: (1) the short cries of fright and single sounds of displeasure. These are usually accompanied by convulsive movements; (2) monotone habitual crying. Bryan (6) found that the birth cry differs from infant to infant and is somewhat influenced by the type of birth. Sharp, deep cries usually follow a quick, expulsive form of delivery, while in the case of premature births, or infants in poor physical condition, a little moan is the typical birth cry. Prolonged labor is generally accompanied by a weak, short and intermittent cry.

Bryan (6) also found in her study of 66 newborn infants that within the first 24 hours after birth, the cry may take on a very definite meaning. When the infant is wet or uncomfortable, the protest cry is a short, staccato one with intervals of silence. If no aid is secured, crying is continued with much shorter time intervals between each cry. Pain is accompanied by a cry which rises in pitch from its inception to its completion. Should this pain be accompanied by increasing weakness, the piercing tone becomes a moan. The rage cry is of greater duration and, due to the holding of the breath, the face becomes purplish and gulping sounds are made. With the quieting of rage comes intermittent sobs and occasionally, tears.

Blanton (4) found that the cries of the newborn varied from one infant to another, and ranged from "a" (as in "at") to "u" (as in "cut"). Most birth cries were not simple sounds but were compound, as "uh" (in "cut"), "nga" ("at"), "u" followed by "wah" ("at"). Sherman (61) in an experiment to test the infant's emotions by studying its crying, found that there was "very little success in judging the emotional accompaniment of the cry when the stimuli were not known."

Most crying is accompanied by kicking of a fairly rhythmic sort. Bryan (6) has reported that in anger the movements are more vigorous and abrupt than in other emotions and the feet are thrust out simultaneously instead of alternately. The experiments carried out at Ohio State University by Pratt, Nelson and Sun (51) and Irwin (25) report that crying seldom occurs without some kind of bodily activity which follows closely the inception of the cry. This mass activity accompanying crying is, according to Irwin (25) the beginning of social behavior because it is a signal for the attendant to do something.

The social influence of crying on other infants has been studied by Blanton (4). Graphophone records of the hunger cry of one infant were made and were played for 6 infants, ranging from one to fourteen days of age. The results proved to be negative. When 2 infants were placed on the same couch, it was found that when 1 cried, the other did not follow suit, even though the crying had shaken the couch and these vibrations, together with the crying sounds, were experienced by the second infant.

The most frequent conditions under which crying appears during infancy has been studied by Blanton (4), and were found to be: (a) hunger, (b) noxious stimuli and (c) fatigue. No uniform set of cries appeared in the different situations.

Sensory equipment of the newborn

What sensations the newborn is capable of experiencing is difficult to determine because sensations are best studied by the introspective method—a method which cannot be used in the pre-speech stages of development. Therefore, the criterion used to determine the presence of a given sensory capacity is some motor response following the stimulation. Peterson and Rainey (47) studied 6 premature infants and found that when birth occurred during the seventh lunar month, sensations were similar to those of the full term infant.

Data obtained from experimental studies of the different sensations will be classified according to the sense organ stimulated.

Visual sensations. Peterson and Rainey (47) found that during the first week of life, 839 out of 944 infants studied responded to light stimuli with signs of discomfort. Pratt, Nelson and Sun (51) found that in the case of 24 infants, there were 95 per cent reactions given to 493 flash light stimulations. Bryan (6) reports that in the 66 infants studied by her, light suddenly thrown on the infant's face brings a more severe reaction when the infant is asleep than when awake.

Sensitivity to color stimuli in the newborn is still an open question. Preyer (52) in 1881 reported that colors cannot be distinguished correctly until the age of three or four years. Canestrini (11) found that particular responses to particular colors are not made by the newborn.

Using a larger number of infants for their study, Pratt, Nelson and Sun (51) reported that the greatest number of specific reactions to light occurred when white light was used as a stimulus; 27 per cent as compared with 24 per cent for yellow, 21 per cent for green, 20 per cent for red and 8 per cent for blue.

Auditory sensations. Forbes (16) reports evidence to show that infants in the uterus, one month before birth, when stimulated by loud noises, react with demonstrable movements. Peiper (46) found that when examining women during the late pregnancy period, a sudden honking of an automobile horn near the woman's abdomen caused well defined movements in the fetus.

Scientists are not agreed as to whether or not the infant responds to sound stimuli by auditory sensations. Of all sensations, hearing seems to be at the lowest stage of development at birth and many infants are partially or totally deaf for several hours or days after birth, due to the stoppage of the ears with amniotic fluid.

Kussmaul (34), Genzmer (19) and Kroner (33) have all reported that loud noises near the ear of the newborn produce little or no reaction. Within a few hours of birth, Peiper (45) found definite changes in the respiratory curves of 4 out of 6 infants tested by loud noises. Testing auditory sensitivity by rattles, low voices, tearing of paper and lip sounds, re-

vealed that in two-thirds of the infants tested by Peterson and Rainey (47) squirming or some similar response was made during the first week of life. Movements of the arms and, sometimes, of the entire body of the infant were found by Blanton (4) to follow laboratory sounds as the Galton whistle, striking of a tuning fork or folding of paper.

Pratt, Nelson and Sun (51) tested 59 newborn infants with such stimuli as tuning forks, electric bells, wooden bells, snappers, etc. Forty-six per cent of the 5,836 stimulations were accompanied by definite movements, of which 35 per cent were movements of the extremities, 34 per cent of the eyes, 26 per cent, general body movements, 3 per cent, sound reactions, 1 per cent head movements and 1 per cent facial movements. The largest percentage of responses was made to the can, snapper and electric bell. Bryan (6) using a small hand bell with a pitch of approximately 512 vibrations per second and a Galton whistle, found that not all infants tested gave evidence of hearing during the first week of life. From the third day, most of the infants gave some response to the sound stimuli.

The ability to distinguish the intensity and pitch of pure tones in 19 infants from ten to fourteen days of age has been studied by Haller (21). Pure tones of great intensity proved to be more disturbing than pure tones of low intensity, while pure tones of high vibration rate resulted in more unpleasurable reactions than pure tones of low vibration rate.

How the newborn responds to such auditory stimuli as the human voice, the striking of a porcelain plate with a spoon and the rattling of a piece of paper, has been studied by Hetzer and Tudor-Hart (22) in Vienna. A group of 14 infants, ranging in age from birth to three days, showed more positive reactions to noises than to the human voice.

Taste sensations. Kussmaul (34) who was one of the earliest investigators of the infant's taste reactions, reported that infants respond to sugar solutions with sucking movements and to quinine, salt and tartaric acid solution with "grimaces of dislike." Preyer (52) concluded that taste reactions are the most highly developed of all sensory reactions and that various taste qualities can be distinguished as seen in the different reflex movements following different stimuli. Peterson and Rainey (47) found that 800 out of the 1000 infants tested gave distinctive reactions to taste stimuli during the first week of life and the remainder during the second week. Positive reactions, accompanied by "contented sucking," followed sweet and salt stimuli, while negative reactions accompanied sour and bitter stimuli.

Blanton (4) unlike most experimenters, believes that the sense of taste is almost dormant at birth. In Pratt, Nelson and Sun's (51) experiment, 28 infants were given 858 stimulations of sugar, salt, quinine, water and citric acid at "room temperature." At the age of one day, there were reactions to 86 per cent of the stimuli. Of these, 25 per cent were to citric acid, 24 per cent to quinine, 19 per cent to sugar, 17 per cent to salt and 15 per cent to water.

Taste sensations, tested by 937 salt

stimulations of 14 infants, gave evidence according to Jensen (30) of differential reactions to .900 per cent solutions as early as the second day. Facial expressions of disgust accompanied differential reactions. No differential reactions to acid milk, glucose, or sterile water were made.

Smell sensations. Kussmaul (34) making a pioneer study of the olfactory sensitivity of the newborn, experimented with sleeping infants. He found responses to asafoetida and oleum dippelii, but not to acetic acid and ammonia fumes. Kroner (33) and Preyer (52) found that the infant refused to take the breast if it had been rubbed with petroleum. Peterson and Rainey (47) using such stimuli as asafoetida, compound spirits of orange, and mother's milk, found high smell sensitivity at birth, which was apparent in such reactions as squirming, grimaces, crying and sucking movements. Canestrini (11), using 20 odorous chemicals as musk, vinegar, chloroform, etc., found 54 negative and 47 positive responses out of 101 experiments. Pratt, Nelson and Sun (51) using similar stimuli, tested 48 infants. The infants reacted to 48 per cent of the stimulations, of which ammonia proved to be the most effective.

Skin sensations (*temperature, touch and pain*). Very few experimental studies of temperature sensations have been made for fear of hurting the infant. Genzmer (19) using cold stimuli, found withdrawal responses. Canestrini (11) found that cold stimuli produced more prompt and pronounced reactions than heat stimuli. The refusal of milk of the wrong temperature and crying in response to water that is too hot or too cold, was interpreted by Koffka (32) to indicate the infant's sensitivity to temperature stimuli.

Blanton (4) reported that on 6 occasions, she has observed shivering within fifteen minutes after birth. Pratt, Nelson and Sun (51) in testing 30 infants with temperatures ranging from 8 to 53°C., found that the infants reacted to 87 per cent of the stimulations, of which 96 per cent were on the day of birth. They found less intense reactions to temperatures warmer than body temperature than to those colder than body temperature.

Investigation of the temperature sensations of 17 infants by Jensen (30) indicated large individual differences in the thresholds. Differential reactions to temperatures of 5° and 55°C. were obtained on the second day.

Touch sensations, according to Sherman and Sherman (61) are present in all parts of the body at birth. Koffka (32) reports that the mucous membrane of the lips is hypersensitive, while the regions of the trunk, thighs and forearms are hyposensitive.

Sensitivity to pain, is, according to Genzmer (19) weak during the first day or two of life. The soles of the feet are the most sensitive areas of the body. Canestrini (11) on the other hand, found the most sensitive areas to be the lips, eyelashes, mucous membrane of the nose and the skin of the forehead. Sherman and Sherman (61) hold that pain responses not only appear earlier in the anterior end of the body, but also develop more rapidly than those in the posterior ends. Koffka (32) maintains that at birth sensitivity to pain is subnormal.

The effect of absence of the cere-

brum on sensations has been studied by Trommer (71) in the case of one infant born without a cerebrum. Overt responses to light, sound, smell, taste and to warmth were absent during the first two days of life, though reflex responses to pain, pressure, contact and cold stimuli could be elicited.

Emotions of the newborn

Experimental studies of the emotions of the newborn have been limited in number but extensive in scope. Watson (73, 74, 75) whose experiment along these lines may be regarded as the pioneer study, distinguished only 3 emotional states present at birth, which may be aroused by only a few, specific stimuli. These are as follows:

1. *Fear*, expressed by sudden catching of the breath, clutching randomly with the hands, sudden closing of the eyelids, puckering of the lips and crying. The principal stimuli calling forth this emotion are sudden removal of support, loud noise, sudden push or pull of the blanket on which the infant is lying when just falling asleep.

2. *Rage*, accompanied by stiffening of the body, slashing and striking movements of the arms and hands, kicking of the legs, holding of the breath, and screaming, occurs when the infant's movements are hampered.

3. *Love*, which comes in response to stroking or manipulation of some erogenous zone, shaking, tickling, patting or gentle rocking. The response consists of cessation of crying, if the infant has been crying, attempts at gurgling, cooing, and relaxation of the body.

Watson's theory of the primary emotions, based on a study of the newborn, has been subject to much criticism and experimental investigation during the last few years. Sherman and Sherman (61), to determine whether, in the absence of the knowledge of the stimulus used, a group of medical students and student nurses could judge accurately the emotional state of the infant, stimulated infants ranging in age from one hundred and twelve to one hundred and sixteen hours. The stimulation took place behind a screen and when it was removed, the observers were asked to report what emotion the infant was experiencing. The results obtained led the Shermans to conclude that "there is no agreement between observers in estimating emotional reactions to stimuli which presumably arouse a given response, even when they see or hear the infant's response, which show that these reactions are not those generally accepted." When judgments of the emotional state from the cry alone were made, the results showed equally great lack of agreement.

To verify Watson's analysis of the stimuli which arouse "rage," Pratt (51) held the arms and noses of 67 infants. Reactions occurred in 96 per cent of the 388 stimulations and consisted of drawing back the head, arching the back, general restlessness and nonspecific body movements. Holding the arms resulted in no action in 58 per cent of the cases, while in the other cases, flexing of the arms and similar minor reactions were made. These results, indicating no "rage" reaction, are directly contradictory to Watson's findings.

Body startle, as an indication of fear, has been investigated by Irwin (26) in criticism of Watson's theory. Twelve

infants, ranging in age from 15 hours to 53 days, were placed in a Pratt experimental cabinet and stimulated by tones coming from a loud speaker placed 4 inches from the infant's head. Body jerk was recorded on a moving polygraph tape. The mean latent time of body startle was .18 second, which is comparable to simple auditory reaction time of adults. Crying never accompanied body startle, though eyelid responses occurred when no other overt response was observable.

To test Watson's contention that loss of support is one of the major stimuli to attention, Irwin (24) dropped 24 infants, under one month of age, two feet while in a supine position. In 12 per cent of the trials, no overt response was made, while in 88 per cent, some movement occurred, 46 per cent of which were confined to the arms while 51 per cent involved both arms and legs, and 3 per cent, crying.

Hollingworth (23) differs from Watson in that he lists 4 primary emotions present at birth—resistance, content, startle and gloom—which he says "constitute the germinal basis of the four major emotional systems of anger, joy, fear and sorrow." The outstanding characteristic of the infant's emotions, according to Hollingworth, is their "wholeheartedness" or complete absence of gradations to stimuli of different degrees of intensity.

Learning capacity of the newborn

The Pavlovian school of Russian physiologists and psychologists deny the ability to learn on the part of the newborn. Marquis (35) to disprove this, investigated the possibility of conditioning the feeding reactions of 8 infants to the sound of an electric buzzer. From the first feeding, each feeding was accompanied by the buzzer. After three to six days of experimentation, 7 out of the 8 infants showed feeding responses (sucking and mouth opening) to the sound of the buzzer, while crying and general activity decreased.

The consciousness of the newborn

For years, scientific interest has been centered on the problem of the consciousness of the newborn, but, because of its highly subjective nature, it is possible to do little more than hazard a guess, based on observations of the infant's behavior and definite knowledge of the development of the infant's sense organs.

One of the earliest descriptions of the infant's consciousness was given by James (28) who states that "the baby, assailed by eyes, ears, nose, skin and entrails all at once, feels it all as one great, blooming, buzzing confusion." Peterson and Rainey (47) on the basis of intensive studies of the sensations of 1060 infants, come to the following conclusions: "there are good grounds for believing that the newborn child comes to the world already with a small store of experiences and associated feelings and shadowy consciousness."

Stern (64) taking a position more similar to that of James (28) than to that of Peterson and Rainey (47) holds that "all that we are possibly justified in assuming is the presence of a dull, undefined foreshadowing of consciousness in which the sensorial and emotional elements are so inextricably intermingled that they may be desig-

nated either as 'sense-emotional states' or 'emotional-perceptive states'."

Koffka (32) states that the "newborn infant experiences the world differently from us adults, just as an unmusical person hears a symphony differently from one who is musical." K. Bühler (9), basing his statement on the observations of infants born without a cortex, holds that "we cannot decide with certainty whether the newborn child already experiences pain and pleasure, whether it has some other primitive form of consciousness or not . . . . observations of children born without a cortex, who are no different from normal children during the first few days, at any rate as far as the broader manifestations of life are concerned, would seem to indicate that the cortex does not begin to function at once."

Testing the newborn

Tests to determine the physiological well-being of the infant at birth have been used for years by physicans. While it would be equally important to know the mental development, as well as the physical, up to the present time no satisfactory infant intelligence tests have been devised.

In 1916, Th. Simon (55), collaborator of Binet, made a questionnaire for the use of parents in testing their babies during the first year of life. Several questions were included to be used for the first day or "first days" (no time limit set) of life. Sample questions are: "Does the child's look indicate a vague contemplation?" (First day); "Does the child make grimaces, when its face is touched by a little cold water?" (First days); "If one touches the lips of the child with the finger, does one get sucking as a response?" (First days).

Furfey (17) has devised a test for the newborn to determine if a factor similar to that of "general intelligence" of older subjects is present at birth. This tests consists of 17 items: the plantar reflex, right and left; the leg withdrawal reflex, right and left; reaction to light; eye convergence; reaction to bell, etc. Sixty-two infants ranging in age from 15 minutes to 343 hours, with a mean age of 91.73 hours, were used as subjects. The results of this series of tests led Furfey to conclude that "the infant at birth is not a mental unit." Neither one of these infant intelligence tests has been widely accepted or used.

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Popularity in Preschool Children: Some Related Factors and a Technique for Its Measurement

HELEN LOIS KOCH

ONE index of the success with which an individual has taken his place in a social group is the degree to which he is enjoyed by the group, the extent to which his associates like to work and play with him. Social effectiveness, so defined, we term popularity. It probably should, contrary to a trend in the literature, be distinguished from sociability—a trait in the composition of which the individual's own interest in and desire to be with people looms large. Popularity, we contend, should be defined in terms of group attitudes; sociability, in terms of the attitudes of the individual.

Popularity has been guaged in lay enterprises and scientific studies in various ways. Choice of the most popular by a simple voting procedure or the selection of traits making for popularity (3) by such a device has resulted in specious yields, propaganda and immediate pressures of various sorts being marring factors. The voting technique, furthermore, usually merely accomplishes the selection of a single individual, seldom making possible the adequate ranking of all members of a social unit. The method extended to include the specification of a limited number of preferred individuals is probably an improvement over the single vote. This procedure has been employed by Hardy (5), for instance, who asked her subjects to name the 5 school fellows liked best, and by Hsia (6), whose subjects were charged with listing the 4 members of their school class whom they would enjoy most inviting to a party. In these latter methods the frequency of the appearance of a pupil's name on the lists furnishes the basis for determining his ranking in popularity. To the extent that some pupils are occasionally not named at all on the ballots, that circumstances prevailing at the time the judgments are registered may weigh heavily, and that not all pupils receive equally thoughtful consideration, the method has limitations.

The difficulties of the single rating (6), weighted with the incubus of personal bias, are too well known to deserve exposition here. An average of a number of ratings is more satisfactory, but this method cannot be employed with young children when the children themselves are to give the judgments. Ranking methods, involving essentially the same mechanisms as ratings, have also been resorted to and, being effective only in the

hands of those most capable of making detailed discriminations, again are not usable with young subjects.

Barker (1), Beaver (2), and Loomis (7), working with Dr. Dorothy Thomas, devised indexes of sociability based on the frequency with which a child during certain time samples makes or experiences social contacts. Since these authors have not, however, distinguished satisfactorily between friendly and unfriendly contacts, their measures, although having the great merit of being derived on the basis of systematic observation of behavior, described better sociability than popularity.

It was the purpose of our study to investigate as a possible way out of some of the difficulties mentioned in the aforegoing discussion the method of paired comparison. The method is essentially that described by Thurstone (9), in his investigation regarding the relative esteem in which a number of races are held by a group of American college students. It does require an expression of opinion from the subjects and does give opportunity for equal consideration of all members of the group.

Since we are primarily interested in using the method ultimately to study the pattern and development of certain social values in children, we chose as our subjects a group of four-year-old nursery-school children—a group including as many boys as girls. There were 20 in the unit when we began but the usual mishaps reduced the number of those who finished to 17—9 girls and 8 boys. The children had played together for at least six weeks and most of them for a year or more.

Our subjects were summoned to the experimenter's[1] room singly, were presented in rather quick succession but not hurriedly with pairs of names, and asked which member of each couple they liked the best. Several preliminary series in which the options were between pairs of colors or pairs of toys were carried through to insure an understanding of the procedure and directions. The usual form of our question was, "Which do you like best—Mary or Ann?" Occasionally, to hold the children's attention, variations were introduced—variations such as, "You know Ann, don't you. And you know Mary? Which one do you like the best?"

To minimize ennui, the child was presented with no more than 20 pairs of names at a session. After he had expressed his preferences, moreover, he was rewarded by being allowed to stamp a picture or two. The children came willing to the exercise. Since daily sessions could not be arranged, it took almost three months to obtain the complete series of judgments. This protraction of the experiment had both advantages and disadvantages. It did minimize the effect of temporary biasing factors such as a child's being in disgrace as a result of a tantrum or being off color for a few days because of a cold.

The pairs of names were arranged in such a way that each child's tended to occur as an initial and final member in a pair in the lists submitted at a single session. The names were distributed so as to occur with equal frequency at the various stages of the judgment

[1] Miss Bonnie Dysart obtained the choices from the children.

sequence. Each pair, moreover, was proffered twice, the order of presentation of the names in a pair and the order of the pairs being reversed. By means of these precautions we hoped to prevent the serious marring of our results by a tendency on the part of young children to repeat the last named of a series of items and to compensate for the effects of lack of interest in the whole project or ennui at any given session.

TABLE 1

Popularity scores of the children

SUBJECT NUMBER	SCORE
9	530
10	397
11	391
1	347
2	304
3	296
12	258
13	246
14	242
15	236
4	202
16	196
5	87
17	75
6	55
7	35
8	00

To the extent we were not thwarted in it by the absences of the children, we rotated systematically the order in which our subject were called upon to express their preferences.

The scaling of the results was accomplished in accordance with the procedure outlined by Thurstone (9). The obtained popularity scores presented in table 1 show a considerable range. These were correlated with the popularity rankings submitted by the group teacher, who was not only a discriminating person but had also long known our subjects. The correlation obtained by the Spearman rank-difference method was +.76.

Since a detailed analysis of the children's choices should yield results of more interest than the final scale values just described, we attempted the quest with a view to discovering: (1) sex preferences, (2) evidence of carelessness or unfavorable routinizing of judgment as the experiment progressed, (3) the probable extent to which the position or time error operated in our data, (4) the degree of stability in the children's expressed preferences, and (5) the relation of this stability to the child's intelligence and popularity.

That the children showed a tendency to select the last item in a pair is indicated by the fact that 68 per cent of the choices expressed favored the second name, the percentages ranging for the individual respondents from 58.8 to 84.2. Only one child showed a partiality for the first name. (See table 2). No child, then, indicated entirely consistently the name in a given position, it being apparent, since we knew the youngsters, that when an individual was involved for whom the respondent had a decided liking or disliking, position did not direct the judgment. Our analysis, however, does reveal that the preferences of some children—those who were less subject to the position error—affect the scaling more than do those of others. With somewhat older subjects this position error could probably be rendered inconsequential.

A survey of the congruence in the

judgments pronounced with respect to particular pairs when the names were presented in the forward and reversed order revealed that 46.3 per cent of the time the same individual was favored in the 2 series. Many and tortuous as the relations are, it is difficult to determine what operates to cause the frequent disparity between the two judgment series. The position error,

TABLE 2

Percentage of judgments made in which the child last named was chosen

SUBJECT NUMBER	PERCENTAGE OF JUDGMENTS FAVORING CHILD NAMED LAST
1	84.2
2	60.8
3	64.9
4	71.3
5	83.6
6	78.7
7	71.3
8	64.3
9	23.4
10	64.3
11	78.4
12	58.8
13	60.3
14	67.3
15	78.6
16	61.1
17	80.4

whatever that involves in the way of suggestion and other influences, is undoubtedly one factor. The child, on the other hand, may have been actually deflected from his original preference, he may have been paying no attention to the task at hand, or he may have aberred into another system of response-making wholly unrelated to his real feeling about the persons supposedly under consideration.

Since the unpopular tended to show the least consistency between the judgments in the two series, a real change of attitude seems a possible factor—i.e., the unpopular child we might expect to change his allegiances most frequently. The 9 most popular individuals, for example, showed 1106 such alterations in expressed preferences; the 9 least popular, 1343; the middle individual being included in both series. Since the correlation of popularity and instability of choice is $-.21$, the relation between the two variables, however, cannot be gross.

That a shift in preference may be due also to indecision is suggested by the fact that a low negative correlation exists ($r = -.105 \pm .057$) between distance of separation on the popularity scale and frequency of inconsistent selection in the two series by members of the group. If the group returns reflect at all the distance between specific children that obtains in the minds of individual group members, this negative r may be taken to mean that, where children are about equally favored, direction of choice tends to be less consistent. The child, in other words, not knowing his own mind, tends to vacillate accordingly. (See table 3).

This tendency to give an opinion in the reversed series counter to that given in the initial one, we thought might also be a manifestation of low intellect, but we discovered that the two variables are uncorrelated. Mental age was determined by the Kuhlmann-Binet test. It is interesting, too, that the unpopular child does not stimulate others to vacillate in their opinion with respect to him more than does the popular child ($r = -.07$).

That a tendency to settle into a position error as the experiment progressed is not conspicuously responsible for the disparity between the preferences expressed in the initial and reversed series is suggested by the fact there was no apparent increase or decrease in the relative frequency with which names in a particular position were chosen in the latter as opposed to the earlier sessions.

TABLE 3

Number of shifts in expressed preferences between initial and reversed order of presentation of names

SUBJECT NUMBER	NUMBER OF PREFERENCE SHIFTS WITH RESPECT TO SUBJECT	NUMBER OF PREFERENCE SHIFTS MADE BY SUBJECT
1	139	169
2	132	108
3	143	87
4	143	141
5	144	164
6	137	181
7	138	146
8	132	143
9	139	147
10	135	116
11	138	159
12	137	113
13	130	98
14	146	109
15	123	162
16	150	129
17	130	168

From the point of view of the problem of the development of social values, it is significant that 7 of the 9 boys chose boys more frequently than girls. (See table 4.) The average percentage of choices favoring boys when the boys were the respondents is 54.1, the range among the individuals being from 43.9 to 68.1. As yet, then, in this group no woman haters appear, but the male is duly appreciative of his own kind. It is also worthy of some thought that when the boys were ranked by the group teacher in the trait, feminity-masculinity, the correlation between these rankings and the percentage of choices favoring girls was +.81. Since so few cases are involved, all we maintain is that the relationship is worth exploring further.

TABLE 4

Percentage of judgments involving a choice between the sexes which favor each

SUBJECT NUMBER	SEX OF SUBJECT	PERCENTAGE OF CHOICES FAVORING BOYS	PERCENTAGE OF CHOICES FAVORING GIRLS
1	M.	53.1	46.9
2	M.	43.9	56.1
3	M.	68.1	31.9
4	M.	55.4	44.6
5	M.	47.4	52.6
6	M.	50.9	49.1
7	M.	58.4	41.6
8	M.	56.5	43.5
9	F.	42.3	57.7
10	F.	44.4	55.6
11	F.	45.9	54.1
12	F.	33.8	66.2
13	F.	40.1	59.9
14	F.	18.3	81.7
15	F.	47.7	52.3
16	F.	53.6	46.4
17	F.	52.5	47.5
Average for the males.....		54.1	45.9
Average for the females.....		42.3	57.7

In the case of the girls, 8 of the 10 favored their own sex, one child 81.7 per cent of time in the bi-sex pairs indicating a preference for a girl. The two individuals tending to favor

the boys were the least popular of the girls. This may or may not be significant. The correlation between the teacher's ranking in feminity and degree of preference for girls is only +.31.

Our findings, when the group as a whole is considered, corroborate those of Moss (8), and of Hsia (6), in indi cating that girls tend to be more popular than boys.

To summarize, we may say that at least as far as our callow four-year-olds are concerned, there is a clear-cut tendency for the boys to favor boys and the girls to favor girls; but evidence of a pejorative attitude toward the opposite sex can scarcely be said to exist. One might enumerate many factors which could contribute to the tendencies exposed. The author is tracking down some of these.

To the extent our popularity scores do reflect the real feeling of the group, we have in them a tool useful in an attack on group values. Light on some behavior patterns related to popularity we are in a position to shed because of an investigation we were making on the social adjustments of fifty or more of the nursery children, among whom were the subjects of the present study.

Because the returns from the investigation of social adjustment patterns are to be reported in detail elsewhere, we shall describe here only very briefly our procedure in obtaining some of the measures listed in tables 5 to 8. Four major groups of results we have available. First, the teacher furnished us judgments on a series of traits for guaging which Dr. Rachel Stutsman and Ione Chesire have developed the procedure. Since these authors have not yet published a description of their findings, suffice it to say here that they employed essentially the method used by Thurstone in the construction of his attitude scales. A series of statements concerning behavior revealing of attitude with respect to willingness to conform to required routines are scaled, for instance, by the method of equal-appearing intervals. A teacher receiving a list of these scaled statements checks those she believes to describe the child she is considering. The score the child receives on the trait is the average of the score values of the items the teacher checked. The method, while still in the category of the rating, forces analysis and weights observations. In table 7 will be found correlations obtained between the child's popularity score and his score on the various traits described by the Merrill-Palmer Personality Scales.

During the year in which the popularity study was in progress and covering a period of about eight months, observations were made of the children's behavior, especially as it related to the solution of difficulties. The data concerning the frequency of appearance of certain relatively objective patterns of behavior were gathered during 400 time samples of one-half minute each, the samples being distributed equally between various kinds of play and routine activities. The child's final score is obtained merely by counting the number of times the behavior pattern was observed in these 400 samples. Data on the reliability of the observers, etc., will be given in another report. We have merely chosen for consideration here some of the more interesting items.

Our subjects, among other things, were given 2 intelligence tests. An attempt was also made to obtain various measures of skin resistance—initial level, average level, relative resistance decrease during stimulation and relative recovery rate during 3 seconds after the peak of resistance change had been met. Our methods were those described by Darrow (4). The children during 2 sessions were subjected to 30 stimuli (15 in each session, the 2 series being highly similar) chosen to produce mild emotional

TABLE 5

Behavior items which correlate negatively with popularity

ITEM	p	P.E.$_p$	RELIABILITY COEFFICIENT
Strike others	−.60	.12	.73
Push and pull others	−.50	.14	.57
Total—vigorous attacks[1]	−.40	.15	.76
Total—mild and vigorous attacks[2]	−.37	.16	.68
Total—escape reactions[3]	−.69	.09	.77
Total—overt escape, no compensation[4]	−.42	.15	.47
Offer no resistance when attacked	−.48	.14	.63
Day dream	−.26	.17	.72
Dawdle	−.81	.07	.86
Make believe	−.21	.17	.81
Refuse children and adults	−.66	.10	.60
Refuse children	−.75	.08	.52
Total—refusing and ignoring[5]	−.67	.10	.68
Play alone	−.45	.14	.77
Play with group	−.04	.18	.78
Criticize others	−.02	.18	.61
Pout and sulk	−.26	.17	.96
Contradict	−.21	.17	.76
Flatter, offer gift	−.30	.16	.71
Make much noise, act silly	−.29	.16	.50
Ask permission	−.31	.16	.69
Smile or laugh	−.03	.18	.91

[1] These include striking, biting, pushing, pulling, holding, tripping, struggling, kicking, blocking, destroying, appropriating another's possessions, and pulling hair.

[2] These include in addition to the items listed in (1) pursuing, asserting ownership, destroying possessions when possessor is gone, snatching possessions when possessor has his back turned, teasing, and ostracizing.

[3] These include running away, moving quietly away, moving to the neighborhood of a protector, clinging to an adult, hiding from an offender, hiding object of dispute, playing alone, day-dreaming, leaving without finishing a thwarting task, forming a new group, seeking the company of younger children, offering no resistance, grimly bearing attack, and merely doing something else when thwarted.

[4] These include the first 5 items listed in (3).

[5] These include refusing the request of a child or adult, refusing proferred help, refusing to let others play with possessions, ignoring requests or remarks, refusing to participate in group exercises, and dawdling.

TABLE 6

Behavior items which correlate positively with popularity

ITEM	p	P.E.$_p$	RELIABILITY COEFFICIENT
Ask for commendation	+.46	.15	.76
Tattle	+.48	.14	.81
Talk about self	+.20	.17	.68
Talk to self	+.13	.18	.69
Converse with others	+.10	.18	.95
Instruct others	+.10	.18	.89
Try to boss	+.07	.18	.90
Listen attentively	+.00	.19	.77
Total—attention-getting devices[1]	+.13	.18	.73
Total—acceptance of situation[2]	+.51	.14	.59
Answer questions	+.19	.17	.71
Watch others	+.10	.18	.66
Parallel play	+.06	.18	.88
Total—automatisms[3]	+.15	.17	.82
Make faces at others	+.31	.17	.65

[1] These include swaggering, boasting, talking of self, calling for help, making much noise, flattering, hurrying to be first, following person whose attention is sought, and asking for commendation.

[2] These include doing as the others do, complying with requests, offering no resistance, waiting turn, answering questions civilly, and listening attentively.

[3] These include mouth manipulation, putting fingers in mouth, sucking thumb, picking or wrinkling nose, manipulating ear, playing with fingers, sniffing, rubbing body, wiggling, squirming, masturbating, fingering clothing, standing on side of foot and swaying, blinking eyes, rubbing eyes, and twisting or handling hair.

TABLE 7

Correlations between popularity score and Merrill-Palmer School personality ratings

TRAIT	p	P.E.$_p$
Compliance with routine	+.92	.02
Respect for property rights	+.39	.15
Sociability with other children	+.24	.16
Ascendance-submission	+.29	.16
Tendency to face reality	+.03	.17
Attractiveness of personality	+.36	.15
Physical attractiveness	+.26	.16
Response to authority	+.29	.16
Independence of adult affection or attention	−.07	.17

responses. Some of the stimuli were intended to be pleasant and some unpleasant. The details of this study will also be reported elsewhere.

Our last measure of interest the parents of the children supplied. The parents were requested to fill out the Cason Inventory of Common Annoyances. This Inventory, the reader will recall, is a list of several hundred

common annoyances. The respondent rates himself on a four-point scale in terms of the degree of his reaction to each annoyance. His score is the average of his ratings. There is room, of course, for cavilling regarding the reliability and validity of the instrument. One might question to what extent the Inventory actually reveals a persistently irritable frame of mind. It seems probable that results obtained with it are miscolored by the response error and reflect the respondents sensitiveness to social standards as well as his desire to conform to them or at least to escape the onus arising from not conforming.

Because of the limited number of subjects in our group and because of the none too satisfactory reliability of some of our measures, the apparent absence of relationship in the case of some items must not be taken too seriously. Where, however, a respectable correlation is found, the relationship between the items correlated may be suspected of being gross. At any rate, many of our results do give a readily interpretable picture.

TABLE 8

Correlations between popularity score and miscellaneous measures

MEASURE	p	P.E.$_p$
Age	+.48	.13
Mental age (Kuhlmann-Binet Test)	+.26	.16
I.Q. (Kuhlmann-Binet Test)	+.21	.16
Mental age (Goodenough drawing of man)	+.51	.14
I.Q. (Goodenough drawing of man)	+.51	.14
Height	−.33	.15
Width-height ratio	+.17	.16
Width-height ratio (boys)	+.10	.20
Width-height ratio (girls)	+.12	.20
Percentage resistance decrease under stimulation	+.05	.17
Percentage resistance recovery in 3 seconds	−.04	.17
Initial resistance (Series I)	−.27	.16
Initial resistance (Series II)	+.06	.17
Average resistance level (Series I)	−.33	.15
Average resistance level (Series II)	−.23	.16
Days attendance at the nursery school	−.08	.17
Days attendance at the nursery school during quarter experiment was in progress	+.57	.11
Cason Inventory of Common Annoyances—mother's score	+.27	.18
Cason Inventory of Common Annoyances—father's score	+.41	.17
Teacher's rating of children on popularity	+.76	.07
Teacher's rating of children on creativeness and originality	+.28	.18

It seems that the child who attacks vigorously, especially that child who strikes frequently or pushes and pulls, tends to be unpopular. (See table 5.) The personal affront and lack of respect for property rights apparently do not meet with much favor. The unpopular child, moreover, according to our results, tends to be the one who

shows the most frequent overt escape reactions. Whether the individual is disliked because he tends to escape or because his tendency to attack results in the necessity for more escapes is not undebatable. It is pertinent in this connection that the total attack and escape scores—i.e., scores representing merely a count of all of the overt attack and escape reactions we observed —correlated only +.10. This suggests but, of course, does not prove that our four-year-olds tend to dislike the child who dodges the issue, ensconces himself behind a protector, and runs away when attacked or thwarted. They also seem to disapprove of the youngster who offers no resistance, is lumpish—a result which lends support to the theory that it is not merely personal attack which engenders unpopularity.

Among the more colorful of our findings is the one that children are averse to those who dawdle, who refuse their requests, and who fail to conform to the nursery routine. The correlation of +.92 between popularity score and teacher's rating of the children on the Merrill-Palmer Scale for Compliance with Routine is also conspicuous. (See table 7.) One might speculate on the extent to which disapproval of a child's actions by the teacher may color the feeling of the other children for him and to what extent a child's lack of conformity to routines causes discomfort to his associates.

As one might expect—though what is cause and what is effect is not so clear—a negative correlation is to be noted between popularity and the frequency with which we observed the child playing alone. It is more interesting that we did not find a large positive correlation between score in popularity and the frequency with which we observed the child taking part actively in group play. Association with the group, for instance, may be characterized by frequent conflicts We did note that the most sociable child in the group—i.e., the one who sought out the others most—indulged frequently in vigorous attacks and probably consequently proved to be least popular. It is for this reason as well as others we would want to distinguish carefully between popularity and sociability.

It is noteworthy that the number of times we observed a child laugh or smile in the 400 samples of behavior taken seems unrelated to the degree to which his playfellows approve of him, as does also his tendency to indulge in automatisms.

Among the traits measured which show a positive correlation with the popularity score we obtained are: asking for commendation, accepting gracefully what happens, doing what the others do when that is expected, and complying with established routines. It is interesting that there is a positive correlation between popularity and a tendency to tattle and to talk about one's self. The act of tattling is, doubtless, disliked, but the virtuous child probably has more opportunity to tattle. The results suggest that the child who wants to be liked, is conscientious and conforms to the group ways, perhaps because of the desire to win the approbation of the group or of those who supervise it, is the one who is liked. On first thought one

might take our findings to mean that the Philistine is the hero in our young society, but closer inspection of the data suggests that mere psitticism is not so likely to win acclaim as is willingness to conform to the routines the nursery staff consider necessary. The positive correlation of .28 (table 8) between popularity and the group teacher's rating on originality is at least slightly encouraging.

The results obtained from the Merrill-Palmer Personality Scales (see table 7) are in general accord with those accruing from our direct observation of behavior. Of the various correlation coefficients, that for Compliance with Routine is the largest. Respect for Property yields the next highest coefficient, while Independence of Adult Attention and Affection returns an insignificant negative r. Consistent with our other findings, the score on the trait, Sociability with Children, is not highly correlated with popularity among our four-year-olds.

Among the findings furnishing material for vigorous speculation is the tendency for parents who score high on the Cason Inventory of Common Annoyances to have the more popular children. The correlation, furthermore, between both father's and mother's score on the Cason Inventory and the child's score on the Merrill-Palmer Scale for Compliance with Routine is +.50. Apparently parents who are sensitive to group standards and labor over their children to make them conform tend to develop children who are enjoyed by the members of the young society represented by our subjects.

Table 8 indicates that the older and brighter children tend to be the more popular. The low negative coefficient between height and popularity need not be taken seriously. It is probably due to the greater popularity of the girls, although it is in line with Kretschmer's contention that the stockier are the more good-natured. When the sexes are dealt with separately, the correlations between the width-height ratio and popularity are negligible. None of the measures of skin resistance seems related to popularity. In that these measures have been revealed to be rather unreliable, we may have a reason for the negative finding.

Length of attendance at the nursery school apparently cannot be given credit for producing the better-liked citizens. Frequency of attendance at the nursery school during the quarter when the judgments were being made does, however, correlate +.57 with popularity score. Perhaps (1) the child in sight is the one most liked; (2) the better disciplined children attend the more regularly; (3) since absences in most cases were due to illness, those with the fewest absences had the fewest health complications and hence were the most amiable; (4) nursery training tends to make children more aggressive (other studies have indicated this) and hence less popular; and (5) perhaps popularity is in part a function of even novelty. The problems the study opens are numerous.

We would make it clear that, since our popularity index is merely an expression of the values of the group studied, we should not expect it to yield an identical picture in other social units. We would also point out that the correlation technique can only put us on the trail of causes.

SUMMARY

1. The method of paired comparison, involving expressions of preference by the members of a group of four-year-old nursery-school children, was used to obtain a popularity score for each child in the unit. These scores correlated +.76 with rankings in popularity which the group teacher furnished.

2. The position error seriously affected the children's choices.

3. The unpopular child in the group tended to be less consistent in his preferences than did the popular one.

4. Intellect, as measured and within the range dealt with, seemed unrelated to the tendency to vacillate in judgment.

5. The girls in the group tended to prefer girls and the boys, boys; though a wholesome heterosexual interest was apparent. On the whole, the girls were more popular than the boys.

6. Among the traits negatively correlated with popularity as we measured it were a tendency to attack, to escape, to offer no resistance when attacked, to dawdle, to refuse and ignore, and to play alone.

7. The indexes showing a positive correlation with popularity were those describing compliance, respect for property rights, a tendency to ask for commendation, and a tendency to tattle.

8. The brighter and the older child seemed the more popular, as did also the one whose parents scored high on the Cason Inventory of Common Annoyances.

9. The sociable child is not necessarily the popular one.

10. Conspicuously unrelated to popularity in our group were our measures of tendency to smile, to indulge in group play, and to be independent of adult affection. Unrelated also were length of nursery school attendance and measures of skin resistance during stimulation.

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The Verbal Responses of Junior High School Pupils in Classroom Discussions[1]

J. Allan Hicks and Margaret Hayes

THIS study is concerned with the verbal responses of junior high school pupils during classroom discussions. The purposes of the study were (1) to devise a technique by which verbal responses might be objectively recorded, (2) to evaluate the number and types of responses of pupils grouped on the basis of combined ranks in general intelligence, school achievement and general personality traits, and (3) to determine age and sex differences in responses.

The subjects were 157 pupils attending the Milne Junior High School, Albany, New York. Their verbal responses were objectively recorded in English, Social Science, Mathematics and General Science classes during discussion periods. The classes observed averaged 19.7 pupils a class and ranged from eleven to twenty-seven pupils. A unit of time of 20 minutes was used for all observations in order that results from various observations might readily be compared. A total of 1147 pupil observations of 20 minutes each was made.

PROCEDURES

A code system was devised for recording pupil responses on a seating chart with a small square for each child. The complete code is given.

V —voluntary contribution not asked for—satisfactory
V̲ —voluntary contribution not asked for—unsatisfactory
C —assigned contribution—satisfactory
C̲ —assigned contribution—unsatisfactory
A —answer to question asked class—satisfactory
A̲ —answer to question asked class—unsatisfactory
a —answer to question asked pupil directly—satisfactory
a̲ —answer ts question asked pupil directly—unsatisfactory
X —question asked by pupil—relevant no one talking
X̲ —question asked by pupil—irrelevant—no one talking
* —question asked by pupil—relevant—interruption
*̲ —question asked by pupil—irrelevant—interruption
D —voluntary comment on lesson—no one talking—of value
D̲ —voluntary comment on lesson—no one talking—of no value
i —relevant interruption—comment—contribution—of value
i̲ —relevant interruption—comment—contribution—of no value
S —irrelevant comment—no one talking
(S)—irrelevant interruption—comment—teacher or pupil talking
R —read selection at request of teacher
~~~ indicates continuous response

[1] From the Department of Child Development and Parent Education, New York State College for Teachers.
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The blocked chart corresponded to the arrangement of desks in the room, with a child's name over each block. Blanks were provided at the top for the following information: teacher's name, grade, section, date of observation, times observation began and ended, length of observation, number of boys and girls present, observer's name and type of lesson. Space was provided at the bottom of the page to note the occurrence of simultaneous comments, questions, and laughter, which were of such character they could not be noted for individuals. All pupils in a class were observed simultaneously by the observer who was seated in the rear of the room.

Fifteen simultaneous observations were taken by two independent observers to test the reliability of this technique. The percentage of agreement between the observers varied according to the degree of classroom control. This percentage, based upon the total number of responses recorded by both observers during all 15 of the observation periods, was 85.6; the highest percentage of agreement for one 20 minute observation was 96.2 and the lowest 71.1. The differences that occurred were usually in the recording of follow-up questions each of which required a very slight knowledge of subject matter and in confusing voluntary comments and volunteered answers to questions asked the class as a whole. In any particular class the two pictures secured by the observers were essentially the same.

In order to obtain a comparison of the classroom responses of pupils with varying leadership qualities, the 157 pupils were divided into 4 groups on the basis of combined rankings of intelligence quotients, achievement quotients, and personality ratings made by the home room teachers. Table 1 gives a description of the 4 groups. These groups were obtained by first dividing the pupils of each of the seventh, eighth and ninth grades into fourths on the basis of combined rankings within the grade on intelligence, achievement, and personality. The corresponding fourths of the 3 grades were then combined into the 4 groups which are designated as leadership groups in table 1. It will be noted that even the 4th group has a

TABLE 1

Description of pupil leadership groups in study of pupil responses

LEADERSHIP GROUP	NUMBER	INTELLIGENCE QUOTIENTS		EDUCATIONAL QUOTIENTS		PERSONALITY SCORE	
		Median	Range	Median	Range	Median	Range
1	40	123	135–113	130	147–112	20	25–12
2	38	115	127–105	119	138–105	17	23–9
3	40	110	120–96	104	134–90	16	23–10
4	39	104	115–92	98	117–84	13	20–8
Total....	157	113	135–92	113	147–84	16	25–8
Q.....		6.3		11.3		3	

median IQ of 104 and a range of 115 to 92, thus showing that according to intelligence test scores the pupils in this study were all average or above average in intelligence. The intelligence quotients were computed from scores on the Otis Self-Administering Tests of Mental Ability, Intermediate Examination and the achievement quotients from scores on the Stanford Achievement Tests. Both tests were given as a part of the regular testing program of the school. The personality ratings were made by the home room teachers with an adaptation of the personality report, revision B, of the American Council on Education.

The following 5 questions were each marked for a pupil on a 5 point scale:

1. How are you and others affected by his appearance and manner?
2. Does he need constant prodding or does he go ahead without being told?
3. Does he work well with a group?
4. Does he get others to do what he wishes?
5. Is he able to do creative work?

A personality score was obtained by scoring each trait from one to five according to the rating on the trait. The maximum score obtainable was thus 25 and the minimum 5.

RESULTS

Table 2 gives data on the verbal responses of the pupils in each of the 4 leadership groups. The results for the boys and girls are given separately and combined. The figures given for all responses are the average number of responses for the 20 minute time unit used in all observations.

From column 1* it may be noted that group 1 shows a decidedly larger average number of responses indicating command of subject matter than group 2 (2.26 as compared with 1.90). The averages of groups 2, 3 and 4 are almost the same. Column 2* shows that group 1 has a markedly larger average number of desirable aggressive responses than groups 2, 3 and 4. Column 3* shows that group 4 has an average larger than the other groups indicating undesirable aggressiveness. Group 1 is low in this respect. The averages of groups 2 and 3 are practically the same, both showing more undesirable aggressive responses than group 1 and fewer than group 4. The boys show a steadily decreasing command of subject matter from group 1 through groups, 2, 3 and 4 while the girls show marked indications of greater command of subject matter for group 1 and markedly poor command of subject matter for group 4. The four groups of boys vary little in desirable aggressiveness and the girls show a marked indication of desirable aggressiveness in group 1, with the other groups very similar to each other. The boys of group 1 show relatively little undesirable aggressiveness and the other groups have averages similar to each other. The girls show little undesirable aggressiveness except in group 4. Boys markedly excel girls in command of subject matter and desirable aggressiveness and also show more evidences of undesirable aggressiveness. The conclusions that we may draw from these data seem to be:

1. The pupils in the upper leadership group show better command of subject matter, more desirable

TABLE 2

Average verbal responses by leadership groups and sex groups

LEADERSHIP GROUPS	SEX GROUPS	NUMBER OF OBSERVATIONS	RESPONSES																					
			V	V	C	C	A	A	a	a	X	X	*	*	D	D	i	i	S	(S)	R	1*	2*	3*
1	Boys	312	0	0	.01	0	.67	.04	.84	.31	.34	0	0	0	.61	.03	.13	.02	.01	.01	.02	2.26	1.62	.24
2	and	275	0	0	.01	0	.38	.07	.91	.24	.28	.02	.01	0	.47	.09	.13	.02	.03	.03	.02	1.90	1.13	.40
3	girls	288	0	0	.01	0	.40	.05	.81	.31	.42	.02	0	.01	.52	.08	.15	.03	.05	.03	0	1.89	1.34	.42
4		272	0	0	0	0	.45	.04	.76	.26	.41	.02	.02	.01	.50	.07	.17	.06	.02	.10	.01	1.88	1.36	.51
All		1,147	0	0	0	0	.48	.05	.83	.28	.36	.01	.01	0	.52	.07	.15	.03	.03	.04	.01	1.98	1.36	.39
1	Boys	109	0	0	.01	0	.68	.07	.94	.39	.34	.01	.01	0	.81	.06	.29	.04	.01	.02	.02	2.73	1.83	.51
2	Boys	85	0	0	0	0	.45	.08	1.00	.25	.54	.04	.04	0	.81	.19	.32	.06	.06	.08	.04	2.58	1.80	.87
3	Boys	128	0	0	0	0	.55	.08	.69	.32	.55	.03	.01	.01	.77	.12	.30	.07	.08	.04	0	2.31	1.87	.74
4	Boys	171	0	0	0	0	.57	.05	.65	.29	.48	.02	.03	.01	.68	.08	.23	.08	.03	.13	.01	2.13	1.73	.66
All		493	0	0	0	0	.57	.07	.81	.31	.48	.02	.02	0	.75	.11	.28	.06	.05	.07	.01	2.41	1.80	.68
1	Girls	203	0	0	.01	0	.67	.01	.78	.27	.34	0	0	0	.51	.01	.05	.01	.01	0	.01	2.02	1.52	.09
2	Girls	190	0	0	.02	0	.35	.06	.86	.25	.17	.01	0	0	.31	.05	.05	0	.01	.01	.01	1.59	.83	.19
3	Girls	160	0	0	.01	0	.29	.03	.91	.30	.30	.01	0	.01	.33	.04	.03	0	.02	.02	.01	1.57	.92	.16
4	Girls	101	0	0	0	0	.25	.02	.83	.22	.29	.01	0	.01	.19	.06	.09	.01	0	.06	0	1.36	73	.26
All		654	0	0	.01	0	.42	.03	.84	.26	.27	.01	0	0	.36	.04	.05	0	.01	.02	.01	1.67	1.05	.16

*1. Command of subject matter: V, C, A, a, D and i.
*2. Desirable aggressive responses: V, A, X and D.
*3. Undesirable aggressive responses: V, A, X, *, *, D, i, i, S and (S).

TABLE 3

Average verbal responses by age and sex groups

AGE GROUPS	SEX GROUPS	NUMBER OF OBSERVATIONS	RESPONSES																					
			V	V	C	C	A	A	a	a	X	X	*	*	D	D	i	i	S	(S)	R	1*	2*	3*
11	Boys	132	0	0	0	0	.52	.06	.92	.25	.33	0	0	0	.50	.09	.20	.03	0	.01	.03	2.14	1.35	.39
12	and	312	0	0	0	0	.44	.05	1.00	.31	.38	.02	.02	0	.43	.07	.15	.03	.05	.03	.01	2.02	1.25	.42
13	girls	399	0	0	0	0	.53	.04	.77	.27	.37	.01	.01	0	.58	.06	.16	.03	.01	.05	.01	2.04	1.48	.36
14		236	0	0	.04	0	.42	.05	.66	.27	.30	.01	0	.02	.56	.06	.10	.01	.02	.07	0	1.78	1.28	.34
15		45	0	0	0	0	.51	.07	.84	.33	.60	0	0	0	.67	.07	.20	.13	.09	0	.02	2.22	1.78	.56
16		23	0	0	0	0	.48	.09	.65	.26	.35	0	0	0	.48	0	.09	0	0	.09	0	1.70	1.31	.27
All		1,147	0	0	0	0	.48	.05	.83	.28	.36	.01	.01	0	.52	.07	.15	.03	.03	.04	.01	1.98	1.36	.39
11	Boys	39	0	0	0	0	.67	.08	1.08	.31	.44	0	0	0	.95	.21	.46	.10	0	0	.03	3.16	2.06	.85
12	Boys	152	0	0	0	0	.41	.07	.87	.33	.42	.03	.04	0	.49	.10	.26	.05	.08	.07	.01	2.03	1.32	.70
13	Boys	161	0	0	0	0	.64	.05	.77	.31	.53	.03	.03	0	.82	.12	.32	.06	.02	.10	.02	2.55	1.99	.73
14	Boys	97	0	0	.01	0	.57	.07	.06	.27	.35	.02	0	.02	.91	.07	.16	.03	.03	.08	0	1.71	1.83	.48
15	Boys	25	0	0	0	0	.88	.12	1.12	.36	1.08	0	0	0	1.16	.08	.36	.24	.16	0	.04	3.52	3.12	.96
16	Boys	19	0	0	0	0	.58	.11	.68	.32	.42	0	0	0	.58	0	.11	0	0	.11	0	1.95	1.58	.33
All		493	0	0	0	0	.57	.07	.81	.31	.48	.02	.02	0	.75	.11	.28	.06	.05	.07	.01	2.41	1.80	.68
11	Girls	93	0	0	0	0	.46	.05	.86	.23	.28	0	0	0	.31	.04	.09	0	0	.01	.03	1.72	1.05	.19
12	Girls	160	0	0	0	0	.46	.03	1.13	.28	.34	.01	0	0	.38	.04	.04	0	.03	0	.01	2.01	1.18	.15
13	Girls	238	0	0	0	0	.46	.03	.76	.25	.26	0	0	0	.41	.02	.05	.01	0	.01	0	1.68	1.13	.12
14	Girls	139	0	0	.06	0	.32	.03	.71	.27	.26	.01	0	.01	.33	.06	.06	0	.01	.06	0	1.48	.91	.24
15	Girls	20	0	0	0	0	.05	0	.50	.30	0	0	0	0	.05	.05	0	0	0	0	0	.60	.10	.05
16	Girls	4	0	0	0	0	0	0	.50	0	0	0	0	0	0	0	0	0	0	0	0	.50	0	0
All		654	0	0	0	0	.42	.03	.84	.26	.27	.01	0	0	.36	.04	.05	0	.01	.02	.01	1.67	1.05	.16

*1. Command of subject matter: V, C, A, a, D and i.
*2. Desirable aggressive responses: V, A, X and D.
*3. Undesirable aggressive responses: V, A, X, *, *, D, i, i, S and (S).

aggressiveness and less undesirable aggressiveness than the pupils in the three lower groups.

2. The pupils in the second, third and fourth groups show only slight differences in command of subject matter and desirable aggressiveness.
3. Pupils in the fourth group show marked undesirable aggressiveness.
4. Boys show better command of subject matter than girls and far more aggressiveness than girls in both desirable and undesirable ways. However, the differences are more marked for the first two characteristics than for the third.
5. Insofar as command of subject matter and desirable aggressiveness indicate successful adjustment to the school, and undesirable aggressiveness is an indication of maladjustment, pupils of the upper leadership group are better adjusted than the pupils of the 3 lower groups, and the boys are better adjusted than the girls.

Table 3 gives the verbal responses of the 157 pupils grouped according to ages and sexes, from eleven years to sixteen years inclusive.

Sex differences have already been noted for the whole group of boys and girls. These differences are consistent through all the age levels represented. There also seems to be a slight trend toward less aggressiveness both of the desirable and undesirable kinds at the highest age level. From these data it would seem that age differences in adjustment to the school do not seem to be significant, except for the probability that the oldest pupils in the junior high school are less well adjusted than the others.

Data gathered by the use of this technique may be used in analyzing

TABLE 4

Verbal responses of an individual pupil

Grade 7C, 1931–32

ENGLISH 4-14-32	ENGLISH 5-2-33	ENGLISH 5-26-32	ENGLISH 6-7-32
D$\widehat{aaa}$a	XiXD	A	$\widehat{X}$DD(S)i Aa
MATH 4-3-32	MATH 5-2-32	MATH 5-6-32	MATH 5-16-32
D$\widehat{X}$	$\widehat{X}\widehat{X}$DDD	$\underline{a}$S	(S)XX$\underline{D}$XD

TABLE 5

Verbal responses of an individual pupil compared with class averages

	NUMBER OF OBSERVATIONS	RESPONSES																	
		A	$\underline{A}$	a	$\underline{a}$	X	$\underline{X}$	*	$\underline{*}$	D	$\underline{D}$	i	$\underline{i}$	S	(S)	R	1°	2°	3°
Class.....	364	.47	.05	.94	.26	.44	.01	.01	0	.35	.09	.14	.03	.04	.06	.01	1.90	1.26	.43
Pupil.....	8	.25	0	.50	.13	1.13	0	0	0	1.13	.13	.25	0	.13	.25	0	2.13	2.51	.76

the responses of individual pupils. Any pupil's responses during the period observed can be reconstructed and compared with the average student in his grade.

Table 4 shows eight 20 minute observations on one child. This pupil's behavior may be reconstructed for any one of these periods. For example, on May 16, 1932 during a 20 minute observation in a mathematics class, this pupil made a smart remark, then asked two questions relevant to the lesson, offered one comment of no value, asked another relevant question, and then offered a comment that was of value in the discussion. Table 5 shows this pupil's responses as compared to the averages for his class. His command of subject matter is below the average for his class and he displays much less aggressiveness of both a desirable and undesirable nature than the average pupil in his class.

Data gathered in this way may be used by different people who may not themselves find it practical to make observations. The use to the principal is obvious. If a conference with the child or his parents seems necessary, the principal has at hand information which can readily be interpreted and which thorows light upon the pupil's adjustment to the school situation. The guidance counselor and clinical worker should also find these data useful for case study work. Also, the home room teacher should find this a valuable means of learning about the behavior in various situations of pupils for whose personality guidance she is responsible.

SUMMARY

A study was made of the verbal responses of 157 junior high school pupils in classroom discussions. A technique for objectively recording pupil responses during 20 minute time units was devised. Pupils were divided into 4 groups on the basis of combined ranks in general intelligence, school achievement and general personality traits. The responses of the pupils of the 4 groups were analyzed comparatively. Age and sex differences were also considered.

From an analysis of the data the following are some of the more pertinent results.

1. The pupils in the upper group showed better command of subject matter, more desirable aggressiveness and less undesirable aggressiveness than the pupils in the 3 lower groups.
2. The pupils in the second, third and fourth groups showed only slight differences in command of subject matter and desirable aggressiveness.
3. The pupils in the lower group showed marked undesirable aggressiveness.
4. Boys showed better command of subject matter than girls and were more aggressive in both desirable and undesirable ways.
5. Insofar as command of subject matter and desirable aggressiveness indicate successful adjustment to school, and lack of command of subject matter and undesirable aggressiveness indicate unsuccessful adjustment, the pupils in the upper group were making a much better school adjustment than the pupils in the 3 lower groups.
6. Age differences, were not marked but there was a tendency for older pupils to be less aggressive than younger pupils.

Grammatical Errors in the Speech of Preschool Children

MADORAH E. SMITH

THIS study is an attempt to determine, through an examination of the extent and type of grammatical errors found in the speech of preschool children, the average age at which children are able to form sentences that are approximately correct and what are the most troublesome points in grammatical speech to a child.

The material used for this study consisted of 305 records of the spontaneous conversation of 220 different children, covering a total of 22,994 sentences or 99,289 running words. The age range was eighteen months to six years. For classification into age groups a child was counted two years old if his age fell within the limits of eighteen and twenty-nine months inclusive.

The children were drawn from English-speaking homes representing all social levels, although the number was greater from the upper classes. The average I.Q. of the children for whom test scores were available (a representative two-thirds of the number) was 110.

The study of their grammatical errors was approached from two angles: improvement in elimination of error with increase in age, and the particular types of errors most frequently found.

With these aims in mind, all errors in the material were carefully segregated. Tabulation was made according to age and according to type of error.

An index of the amount of error in each child's conversation was calculated by dividing the number of errors made by the number of words used. This gave a score of 1.00 for a baby using entirely one-word sentences, and of .00 for any record which contained no errors whatsoever. The 1.00 error index for one-word sentences resulted because, too much guesswork being required to complete them grammatically, they were included in the list of incomplete sentences. Although conceivably two or more omissions might have occurred, but one error was counted in such cases. In longer sentences, if more than one necessary word was omitted both omissions were counted as errors. Incomplete sentences were divided into two groups: those in which some form of the copula was omitted and those in which some other verb or object or subject was omitted. Neologisms, foreign words, baby words and slang were not counted as errors but were given separate consideration. The use of one part of speech for another when the child did not know how to make the correct transformation was counted as an error.

NEOLOGISMS; FOREIGN AND BABY WORDS

In view of the number of very young children included, there were surprisingly few of such words. Sixty-seven of the records were of Honolulu children. In these records, it was found that 2 Hawaiian words appeared: "kaukau" for "food" used by two children and "pau" for "finished" or "enough" by six children. These words are both very frequently used by English-speaking adults in the Islands who know practically no other Hawaiian words.

The baby words used by more than one child were "choo-choo" or "too-too train" by 14 children, "bye-bye" by 7, "bow-wow" or "wow-wow" by 4, "hanky" by 4, and "tockies" by 2. "Uh-uh" and "um-hm" instead of "yes" and "no" were used by 27 and "huh?" for "What did you say?" by 33 children, but these are so common in colloquial speech that they were not included in the error index.

Among the neologisms and individual baby words or phrases were a number of duplicated sounds. A list of these, not including those mentioned above, follows. "Me-me" for "come in," "gung-gung" for "grandma," "dup-dup dere" for "up there," "pup-pup high" for "up high," "go night-night" for "go to bed," "boo-boo boat" for "steamer," "chih-chih" for "chicken," "yum-yum" and "ninny"

TABLE 1

Frequency of errors

	AGE IN MONTHS				
	24	36	48	60	66-72
Number of records	65	74	75	75	5
Average error-index:					
Per child	58	21	7	5	6.5
Boys	67	19	7.4	4.6	4.5
Girls	50	23	7.5	6.1	
Errors per 1000 words:					
All types	363	152	73	50	55
Incomplete sentences:					
Copula omitted	38	15	4	1	1
Others	225	71	36	28	32
Articles	39	15	3	2	2
Verbs	30	24	17	12	11
Prepositions	11	8	5	2	4
Nouns and pronouns	6	4	2	1	1
Agreement	8	6	3	2	1
Confused parts of speech	3	5	1	1	½
Other errors	3	3	2	2	1
Age differences—years	2-3	3-4	4-5	2-5	
Average error-index in	37 ±7.6	14 ±5.6	2 ±3.9	53 ±6.5	

for "food," "ingungun" (?) and "dar-dar" (?). The last 2 were not mere babbling, for they were clearly used as words in the midst of otherwise intelligible sentences, but their meaning was not ascertained. All but the last 2 of these duplicated words were found in the records of the two-year-old children.

This tendency to repetition of sound in baby words is seen not only in the baby language of many nations; but also in the amount of repetition of words and phrases found in our records which amounted to 5 repetitions per hundred words for our entire group or fifteen per hundred at two years, five at three, two at four and one per hundred at five years.

Non-repetitive neologisms for which the meaning could be determined were "tat" for "what is that?" at two

TABLE 2

Types of errors

Incomplete sentences				5,716
Omitted copula			683	
Others			5,033	
Verb errors				1,666
Use of auxiliary			680	
Got			360	
Ain't or hain't			138	
Other errors				
Conjugation			478	
Past tense regular		57		
irregular		188		
Participles present		12		
past		48		
Future tense		163		
Transitive and intransitive			10	
Errors of agreement				377
Subject-verb			335	
Others			42	
In use of noun and pronoun				227
Gender noun 1 pronoun 10 both			11	
Number 80 5			85	
Case 24 107			131	
In use of article				703
In prepositions				445
Sign of infinitive			168	
Other errors			277	
In use of negative				47
Other confusions parts of speech				175
In use of comparative				9
Relative or conjunction omitted				68
Other omissions				27
Redundancy				175
Errors in word order				37

years, "ra" for "growl" and "lasser-noon" for "yesterday afternoon" at three years, "slobbing-side," "toppy-head" and "tigoo" all used as pet names to her baby brother by a four-year-old girl, "razor-bleezers" for "razor blades" also at four years, "squibbled" and "squirreled" for "crooked" and "twisted" and "dabbish" for "mussy-looking" "trackender" for "tractor" and "shorthander" for "one who writes shorthand" at five years. Most of these words can be explained as farfetched mispronunciations or the fusion of 2 correct words. "Ra" used in the sentence "He would ra at him" is onomatopoeic.

ERRORS

There were 9531 errors found or about one error for every ten words.

Incomplete sentences

The most common type of error was the omission of an essential word or words leaving a distinctly incomplete sentence. For every hundred words spoken at two years, there were 26 omissions, 9 at three, 4 at four, and 3 at five years. The omission of the copula was so common that it was listed separately. At two years, it was omitted in 70 per cent of the sentences where it clearly belonged, at three years in 32, at four in 8 and at five in only 2 per cent of the cases where it should have been used. There were 4 such errors per hundred words at two years falling to 1 per thousand at five.

Verbs

Next in frequency were errors in the use of the verb. These errors occurred 4 times per hundred words at two years and were reduced to 12 per thousand at five. There were 1666 errors altogether in the use of the verb, not counting the omission of verb or copula nor errors of agreement nor the confusion of a verb with another part of speech, which are listed under other headings. Of these errors "got" was used erroneously 60 times and "ain't" or "hain't" 138 times.

The use of the proper auxiliary was the most frequent error found. Aside from its omission in the future tense, there were 680 such errors. The auxiliary was often omitted altogether and the most common error in choice of auxiliary was that of "can" for "may." Sixty-six per cent of the times an auxiliary should have been used it was omitted at two years, this per cent decreasing with increase of age to 7 per cent at five years.

Of the 478 errors in conjugated forms, 245 were made in forming the past tense. Of these, 188 were in conjugating irregular verbs. As soon as the child begins to use the past tense, he appears to generalize and tries to conjugate all verbs regularly using, for example, "catched" and "runned" instead of the irregular forms. This was the most common type of error in the use of the past tense but sometimes a participle was used instead of the correct form as "done" for "did" or "seen" for "saw." The 57 errors in the use of the past tense of the regular verbs were most frequently due to failure to conjugate at all rather than to using the wrong ending.

The next most troublesome tense was the future in the use of which 163

errors occurred. These were mostly through failure to use the form at all, the present tense taking its place. Forty-eight errors occurred in the use of the past, 12 in that of the present participle or 60 for all forms of the participle. The most common error in this group was "broke" for "broken" which occurred 10 times.

Only 6 errors were found in the use of the present tense, all at four and five years: "went" being used three times for "go," "be" for "are" twice and "lost" for "lose" once.

Ten errors occurred in using a transitive verb as an intransitive or vice-versa; "lay" for "lie" being the only pair of such words confused more than once.

All verb errors decreased in frequency with age except in the case of "got" and "ain't" which increased by 1 word per thousand each year from 3 per thousand at two years to six at five.

Nouns and pronouns

Errors in the use of the noun numbered 105 and of the pronoun 122. Their frequency falls from 6 per thousand words at two years to 1 per thousand at five. The use of the correct number was the most troublesome point with nouns, 80 of the noun errors being of that type. The majority of these errors consisted in the wrong formation of the plural of nouns which have irregular plurals; examples are, "mans," "mens," "tooths," "foots." In other cases the plural ending was duplicated as in "biteses" or the singular was used instead of the plural and a few times the plural form for the singular. The possessive sign of the noun was omitted 24 times. The wrong gender was used once in the case of nouns and ten times in the case of pronouns.

Case was the most troublesome feature for pronouns, 107 such errors occurring altogether. Practically all the errors after fifty-four months are of case in pronouns or number in nouns, almost all the children by that age having mastered the use of the possessive in nouns, gender in either nouns or pronouns and the use of number in pronouns.

Articles

The use of the article is learned relatively late. In these records, 703 errors in its use occurred, in almost all cases the error being one of omission. In a few cases however "a" and "an" were confused or the definite article confused with the indefinite. At two years 70 per cent of the times an article should have been used it was omitted, 30 per cent of the time at three years and 6 per cent at four while the oldest group still omitted or used articles wrongly 3 per cent of the time.

Agreement

Of the 377 errors that fall into this class, 335 were in the wrong agreement of subject and verb of which "he," "she" or "it don't" numbered fifty-six. This last error, so common with adults, remains constant from three to six years while all other errors of agreement fall from 8 per thousand words at two years to 1 per thousand in our oldest age group.

Prepositions

Errors in the use of the preposition were divided into two groups: 168 of these errors consisted in the omission

of the sign of the infinitive, 277 were errors, mostly of omission, though a few times a wrong preposition was chosen as "in" for "into." At two years, 42 per cent of the infinitive signs and 18 per cent of other prepositions were omitted; by four years these percentages had dropped to 8 and 5 respectively after which improvement was irregular.

Parts of speech confused

One part of speech was used for another 175 times or 3 times per thousand words at two years, 5 times per thousand at three and less than once per thousand thereafter. The most frequent wrong use of this type was that of a noun (92 times) for the first person pronoun which is an error deliberately encouraged by parents who use their own and the child's name instead of pronouns in talking to babies. The other errors of this type are due to inadequate vocabulary, the child, for instance, using a verb he does know for the corresponding noun which he has not yet learned. Some such uses are found in the following examples: At three years; "the stir," "a making man," "give me the rub" (eraser). At four years; "I am down to the low" (bottom of page), the "bang" or "shoot" for "gun," "That sure is a pretty decorate," "Please, sharp the pencil." At five years; "The change stick." Other confusions were of adverb and adjective, such errors as are frequently found among older children.

Miscellaneous errors

The remaining errors taken altogether at no age exceeded 3 per thousand and numbered 222 in all. Sixty-eight of these were omissions of a relative or a conjunction when such a connective was essential, and 27 more were omissions of other parts of speech not discussed above where the word omitted was necessary for clearness or correctness of speech.

Nine errors occurred in the comparison of adjectives or adverbs; for example "quicklier." These were all of regularly compared adverbs and adjectives as the irregular forms seem to be learned as separate words and one of them "more" is used quite frequently and correctly at two years. Thirty-four cases of redundancy occurred, most of which were the addition of unnecessary prepositions as in "He prints it up," "The airplane landed up." Forty-seven errors in the use of the negative were found. At two and three years, all of these were in the use of "no" for "not," but almost all the errors in the use of the negative by the older children were in using a double negative, an error occurring for the first time at three-and-a-half years.

Word order

This type of error occurred 37 times. It was seldom found singly in any child's record and the majority of even the youngest children's records were quite free from such errors. One small boy who was observed at different ages from eighteen months to five-and-a-half years was a particularly crooked talker at four years and ten of these errors occurred in records of his conversation taken at three years ten months and at four years four months. He was backward in talking and his

earlier records consisted of only or mainly one-word sentences where word order errors would have small chance of occurring. At the time he started to print, he showed some tendency to mirror-writing and now, at almost twelve years, he reverses the order of letters in his spelling. Examples of word-order errors by this boy are: "Where you did hide?" "This I want." "See 'em dere in," and by others, "Eat soup warm."

Error indices

Averages of the error indices for the children at each age are given in table 1. The differences from two to five and from two to three years are decidedly significant and from three to four years, the chances are 994 in a thousand that the true difference is greater than its sigma.

As in other sex comparisons as to the development of language, the girls are better than the boys at two years but thereafter the advantage changes at each age level studied.

For 36 children repeated records from two to six each were available. Their average improvement for each successive half-year from eighteen months to six years is, in order, 17, 29, 15, 11, 4, 3, 0, 1½ and 1 per thousand. Improvement is greatest from two to two-and-a-half years then gradually less with very little gain after four-and-a-half.

By the time the child is six years old, most of his errors in speech have been eliminated except such as he commonly hears spoken by his elders. Not counting the verb errors, "he don't," "got," "ain't," and "can" for "may" the verb errors at five have decreased to 5 per thousand words and no other type of error except incomplete sentences occurs more than twice per thousand words. By this time the child would be able to speak correctly if he did but have a good example before him. Among the records of the 15 children from sixty-six to seventy-two months old, 2 were perfect. Both of these children came from homes of above average in social class and had well-educated parents. One child was a boy, the other a girl and both had high I.Q.'s. Only 1 of these fifteen children whose error index exceeded three came from a home where correct English was spoken and this child had for some time attended a kindergarten where the majority of the pupils came from bilingual homes. Considering the 4 children of this group who had attended such kindergartens, we find their error-indices to average 4.8, the 3 other children who came from homes of the upper social class averaged 1.0 and the remaining eight 6.2. At five years, these 3 groups averaged 4.6 for the 12 in the kindergarten attended also by bilingual children, 4.4 for the 45 others from the middle and upper social classes and 7.7 for the 18 children from the laboring class. As the children from the better homes averaged higher mentally that might be one reason for fewer errors especially at the younger ages so this comparison was not carried below five years by which time the child is capable of reasonably correct speech.

CONCLUSIONS

1. There is a strong tendency to rhythm in the vocalizations of very

young children seen in the fact that the majority of their neologisms and corruptions of words and phrases contain duplication of sounds.

2. Children are able to generalize in the use of inflected words often before they are three years old; this tendency being so marked that a high percentage of their errors of inflexion are due to the extending of rules for the formation of regular forms to other words irregularly inflected.

3. Although the immaturity of the child is responsible for the greater proportion of his errors at two and three years, the fact that at five and six years, the only errors occurring more than once per thousand words, are those that are among the commonest in the speech of adults would suggest that by the age of five the primary factor of incorrect speech in the child is the poor example set by those around him and with a good example, he would be capable of correct grammatical speech.

4. The earlier development of baby girls is again evidenced in the lower percentage of error in their speech at two years.

5. Omissions of different types and errors in inflection comprise a large majority of the errors found.

Brief Reports

A Study of Outdoor Play, Appetite and Afternoon Sleep of Young Children

THIS investigation was undertaken to determine whether or not in the case of young children any interrelationships exist between the following factors: (*a*) the length of time spent in outdoor play during the morning, (*b*) the food consumption at the noon meal and (*c*) the afternoon sleep. The subjects observed were 34 children attending the University of Nebraska Nursery School, 18 boys and 16 girls, ranging in age from two years nine months to four years eleven months with a mean age of three years ten months.

For a period of eight months daily records (5 school days per week) were kept for *each child*, as follows: (1) the length of time in minutes spent out of doors during the morning; (2) the calories consumed at the noon meal; (3) the length of time required to eat the meal; (4) the length of the afternoon nap; (5) the time required to go to sleep after going to bed.

GENERAL PROCEDURE FOR COLLECTION OF DATA

Outdoor play

During the majority of school days throughout all seasons of the year the children spent a part of the morning indoors and a part outside, the length of time given to each varied according to the character of the weather. On mild sunny days the children were out of doors almost the entire morning, but if the day was stormy or extremely cold they remained inside. The time spent out doors varied from zero to two and a half hours; this maximum and minimum remained the same during all seasons of the year. The exact number of minutes on the playground in the morning was recorded daily for each child by the teacher in charge on specially prepared record forms. The playground was large and sunny permitting a great deal of running about and was equipped with play apparatus stimulating active exercise. The indoor rooms provided less space than the outdoor playground and the equipment was designed for less active play.

Food consumption

The children ate the noon meal at the school. These meals were all prepared at the school by the same individual and all food materials were weighed or measured. The portions of food served to each child were measured according to a definite standard set up for each food served. The general table procedure was as follows: The children were served the first course. When they had eaten all of this food they were allowed to have extra helpings (one-half the size of the

original portion) of whatever they wished, or they were given dessert. If, after finishing the dessert, they desired more vegetables, milk, etc. this was given to them. If any food served at the beginning of the meal was not eaten no second helpings were allowed and no dessert was given. The children were not urged to eat and no comments were made on their attitudes toward the food. Four or five children ate at a table with an adult who kept a record for each child indicating the amount of food consumed, the amount uneaten, the number of extra servings and the number of minutes required by each child to eat the meal. The calories consumed at each meal by each child were calculated from these records.

Afternoon sleep

The children went to their cots in the sleeping rooms directly after luncheon. They usually slept as long as they wished although a child was occasionally awakened to be ready for school dismissal at 3:30. The teachers in charge recorded daily for each child (*a*) the time of going to bed, (*b*) the time of going to sleep (judged by cessation of movement, closed eyes and regular breathing) and (*c*) the time of awakening. From these records the length of the nap and the time required to go to sleep were estimated.

Treatment of the data

In order to determine whether or not any interrelationships existed between the time spent out of doors, the food consumption and the afternoon sleep, the following statistical procedures were carried out. All daily records were divided into four two-month intervals, those for (1) December and January, (2) February and March, (3) April and May and (4) October and November. Pearsonian coefficients of correlation were computed for *each child* individually for each two-month period between.

a. The number of minutes out of doors and the calories consumed at the noon meal.
b. The number of minutes out of doors and the number of minutes spent at the table for the consumption of the meal.
c. The calories consumed and the length of the afternoon nap.
d. The calories consumed and the length of time required to go to sleep.

This seasonal grouping of the records was used in order to offset the influence of the probable increase in the children's food consumption as the experiment progressed, due to physical growth. During two months the growth of a child and the consequent increase in food requirement changes but slightly. Since the time spent out of doors was shorter at the beginning of the experiment (December) and increased in length as the weather grew warmer, a spurious relationship might have been indicated between the amount of food consumption and the length of time spent out of doors had not the records been thus subdivided. Coefficients of correlation were obtained for each child individually rather than for the entire group of children because of the large individual differences in the food consumed and the length of nap, and because of variations in nursery school

attendance. The total number of usable records was *1917* for both caloric intake and time out of doors; *1818* for both time out doors and time for food consumption; *1755* for caloric intake and length of sleep; and *1206* for caloric intake and time required to go to sleep. The average number of records for each subject for each two month interval used in computing the various coefficients of correlation was 26. When there were fewer than 18 records for a subject in any two month interval for the two variables under consideration, these records were discarded.

TABLE 1

Averages of the coefficients of correlation between the caloric intake and (a) the time out of doors, (b) the time at the table, (c) the time required to go to sleep, (d) the time out of doors and the minutes at the table

	DECEMBER AND JANUARY		FEBRUARY AND MARCH		APRIL AND MAY		OCTOBER AND NOVEMBER	
	Average r	S.D.	Average r	S.D.	Average r	S.D.	Average r	S.D.
Caloric intake and time outdoors	+.06	.15	.00	.22	−.14	.19	−.16	.12
Time outdoors and time at table	−.08	.23	−.07	.29	+.02	.26	−.04	.21
Caloric intake and length of sleep	−.02	.21	−.05	.15	−.01	.21	−.08	.19
Caloric intake* and time to go to sleep			+.13	.23	−.02	.21	+.10	.20

* No records were made of the time elapsing between going to bed and going to sleep during December and January.

Results. For each of the two month periods, the coefficients of correlation obtained for the individual subjects have been averaged, and the standard deviations of these averages calculated. Table 1 presents a summary of these data.

Morning outdoor play and appetite

a. *Noon food consumption.* Considerable emphasis is placed in the child care and training literature on the importance of outdoor exercise in stimulating appetite. Our figures do not show that variations in the length of outdoor play have any immediate influence on the food consumption in the case of the subjects observed. The seasonal averages of the coefficients of correlation are all very low, the range of the r's for the individual cases is from −.45 to +.42, 27 items are positive and 45 negative. The individual children were quite inconsistent from season to season. Of the 5 subjects observed during all four periods, only one shows consistent behavior in regard to the factors under consideration, with four low positive coefficients of correlation. Of the 8 subjects observed for three periods, not one has consistent negative or positive items throughout the experiment.

b. *Outdoor play and time required to eat luncheon.* Again we find little evidence of relationship between the two variables considered. The coefficients of correlation for the individual cases are in general low, 35 being positive and 36 negative. The range is

from −.95 to +.46 with averages for the different periods of −.08; −.07, +.02 and −.04. The same inconsistency is shown by the subjects who were observed for consecutive periods, only two being consistent for four seasons and one for three, with these items all very low.

The subjects were healthy children who did not attend the nursery school when they were ill or when they had colds. They all spent a good deal of time out of doors if the weather was suitable, probably as much or more than the average pre-school child. If comparison had been made between these children and children who had been kept indoors for long periods different results might have been obtained. It is possible also that active exercise may produce a certain amount of fatigue which has the immediate effect of lessening a child's appetite, and counteracting the stimulating value of the fresh air. The child may be more tired on days when he plays hard outside all the morning than on rainy days spent in the house with the result that he eats about the same amount of food on either occasion.

Food consumption and the afternoon nap

a. *Length of nap.* The figures are very similar to those previously discussed. Practically all of the coefficients of correlation are low and the range is from −.69 to +.53 with seasonal averages of +.06; −.05, and −.01. There are 25 positive items, 40 negative and two zero. In the cases of the subjects observed for three or four two month periods, only one has consistently positive or negative items throughout.

b. *Time required to go to sleep.* These coefficients of correlation range from −.43 to +.46 with averages of +.13, −.02 and +.10. There are 25 positive and 15 negative items and one zero, and the same inconsistency from period to period is evident from an examination of the r's for the individual subjects. Evidently the amount of food consumed at the noon meal had little if any effect on the length of the nap immediately following, or upon the length of time required by the subjects to fall asleep.

Age and sex comparisons

The figures were divided into groups, (*a*) those for the children under 48 months of age, and (*b*) those 48 months or over. The individual coefficients of correlation were averaged, and compared for range, direction and consistency for both age groups. No differences were apparent between the older and younger children and the figures for both groups closely resembled those for the subjects as a whole. Similar results were obtained when the children were divided according to sex.

CONCLUSIONS AND DISCUSSION

In the case of the subjects studied who may be considered as typical, well, pre-school children, there appears to be little, if any immediate relationship between variations of 2½ hours in the length of time spent out of doors in the morning; the appetite for luncheon (as judged by the amount of food consumed and the time taken to consume it); the length of the afternoon sleep; and the time required to fall asleep after going to bed. Doubtless such factors as general health, whether or

not the food is liked, or the method of training of the children in regard to food and sleep habits have more influence on the food consumption and sleep than the variables under consideration. Dunshee (1) reports that the subjects observed by her were definitely influenced by the particular adult at the table; and Staples (2) reports a significant difference in the length of nap and in the number of naps missed by the same subjects under the supervision of two different nursery school teachers. Accurate records were not available for the subjects' food consumption, sleep and outdoor play for the entire 24 hours. It is possible that a long play period out of doors in the morning, while not having any effect on the childrens' noon meal and nap following, may definitely influence the total sleep and total food consumption.

SUMMARY

1. For 34 pre-school children daily records were kept for four two month intervals as follows: (*a*) The length of time spent out of doors in the morning, (*b*) the calories consumed at the noon meal and (*c*) the length of time taken to eat the meal, (*d*) the length of the afternoon nap, (*e*) the time required to go to sleep after going to bed.

2. Coefficients of correlation were worked out for each subject for each period between each of the two variables stated above.

3. These coefficients of correlation were nearly all very low, and well distributed between positive and negative items. When these coefficients of correlation were averaged for the entire group of children, the result was, in the case of each pair of variables, close to zero.

4. There appears to be, in the case of the subjects observed, little if any immediate relationship between the amount of morning out door play and the noon food consumption, or between the noon food consumption and the afternoon nap.

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Responses of the Pre-School Child

THESE studies were made as a contribution to the results obtained by other investigators on performance of pre-school children.

WALKING ON AN ELEVATED BOARD

The walking board used in this experiment was similar to the one used by Baldwin and Stecker (2). It was 8 feet long, and 2¼ inches wide. The top surface was four inches from the floor, and the board was supported by four braces (two at each end) resting on the floor. The top surface was marked off in inches, with numbers from 1 to 25, to make the reading as

easy as possible. On one vertical side were red lines marking five-inch divisions and numbered in actual inches up to 95. These lines were found to be more easily read than the lines on the top.

The directions were simple. The child was assured that the board was stable, by a brief statement of the fact, and by moving the board so that he could see for himself. This feature was treated very casually—that he might be assured of its stability, but it was not elaborated upon lest any idea that it might be unstable should be conveyed to him. Then the child was told to walk from one end of the board to the other; if he stepped off, he was to step on again at the same place and continue walking. In one or two cases where the child seemed timid or seemed not to understand, the experimenter demonstrated what was to be done.

A record was kept of the time it took the child from the instant he started to walk at one end until he stepped off at the other end. At each step-off a record was made of the distance covered, and the number of step-offs was recorded. Notes were kept on the manner of walking. Three trials were made; one on each of 3 successive days.

In scoring we followed the plan used at the University of Iowa, which was a modification of Johnson's (3).

Score 0 points for the child who refuses to try.

Score 1 point for the child who although it overcomes its timidity sufficiently to put one foot on the board, often cannot keep the other on long enough to take a real step, and so continues walking in this manner to the end of the board.

Score 2 points for the child with a slightly better degree of development who stays on the board but only by turning sidewise and sliding along with feet at right angles to the board.

Score 3 points for the child who walks the board one foot before the other, not alternating.

Score 4 points for the child who alternates the feet but walks slowly with many step-offs and with little space between the feet or with the toes turned far out.

Score 5 for the child who walks rapidly and confidently with long steps and few step-offs.

The score alloted to each child was that of his best trial.

To one group of 10 children the test was given during the third week of school, to another group of 12 children it was given during the fifth week.

The results of the experiment for both groups are shown in table 1.

Although our data are limited a comparison with the results obtained at the University of Iowa is interesting. They tested no two-year olds; we tested 8, two of whom, however, were on the eve of being three years old. At three years the Iowa average score was 2.3; our average score for three-year olds was 4.3. The Iowa score at four years was 4.2; our score for our one four-year old was 5. However, eight of our thirteen three-year olds scored 5; three of them scored 4; and two scored 2. It is significant that the two three-year olds who scored only two were both thumb-suckers, were both given to much talking and crying,

and were the only two of the group who were content to just stand around and look at the other children and ask, "When is my mama coming?"

Of the 6 children with ages ranging from two years and six months to two years and two months—only one scored above two; two scored two; and three scored just one. But at that age incomplete motor control is to be expected.

(3) The motor instability correlated also with emotional instability, as seen in the cases of L. S. (age 3 years, 2 months) and Bob S. (age 3 years, 6 months) both of whom had a score of two.

(4) There also seemed to be a correlation between achievement on this test and personality. The children who showed self confidence and assurance in other situations, showed it likewise in this experiment and vice versa.

(5) The difference in the time the tests were given seemed not to matter. The score depended upon the age and stage of maturity, not upon the number of weeks the child had attended the school.

TABLE 1

Scores for walking board

AGES	THIRD WEEK GROUP		FIFTH WEEK GROUP		COMBINED		BALDWIN AND STECHER SCORE
	Number of cases	Mean score	Number of cases	Score	Number of cases	Score	
4–6 to 4	0		1	5	1	5.00	4.2
3–11 3–6	1	2	4	5	5	4.40	2.3
3–5 3–0	3	4.66	5	4	8	4.25	
2–11 2–6	3	3.33	0		3	3.33	None
2–5 2–0	3	1.83	2	2	5	1.90	

The results of the experiment point to a few general conclusions: viz.,

(1) The value of trying the test on three days was doubtful, as some did more poorly on the last two days than on the first one, due to their loss of interest in the experiment as a "game."

(2) The results seem to correlate with age. The older children walked steadily with alternate steps. The younger children walked with their feet at right angles to the board or with one foot on the floor.

SPONTANEOUS DRAWINGS

In this spontaneous drawing experiment the child was given a sheet of drawing paper 9 x 12 inches, was presented with a box of large colored

lumber pencils, and asked to draw anything he wished. Records were kept of the movements used, attempts to represent objects and the choice of crayons.

The subjects used ranged from two years and two months to four years in age.

The following record reveals the findings:

1. Pounding with crayon on paper—75 per cent.
2. Rubbing crayon on side or end—50 per cent.
3. Circular scrawls, i.e., round and round—75 per cent.
4. Angular scrawls, i.e., up and down and back and forth—62½ per cent.
5. Attempts to represent objects—75 per cent; of which 62½ per cent were houses.
6. Choosing two instead of one crayon—50 per cent.
7. Making a choice of color to be used—75 per cent; 50 per cent chose warm colors; 25 per cent cool colors.

The younger children were for the most part still in the scribbling stage of drawing when left undirected. The scribbling stage is to drawing what babbling is to speech according to Stern (4). It is simply an outlet for motor energy. They made many angular scrawls one of which one of the two-year olds called a dog. With that one exception they made no attempt to represent an object. These children showed no color preferences, but took the crayons as they came. This is in agreement with Eng's (2) study of her niece. She reports that the characteristic feature during the first and second year was found to be scribbling—first wavy, then circular, then variegated, and finally with suggestion of the use of the "human formula."

The children whose ages ranged from three years, three months to four years used angular and circular movements. They attempted to represent objects, chiefly houses; and they did pick and choose their colored crayons.

Three of the older ones of the group, with ages ranging from four years to three years, eight months, eliminated entirely scribbling, showing they had entered the third stage. S. H. was always drawing houses, but instead of drawing the house as a whole she drew each room separately. She also drew raindrops, a tent, and a boat. In addition to drawing a house Bill S. drew a man with the essentials, head, arms, and legs. J. S. drew rectangles and triangles to represent houses. She also made A B C's, although in two out of three trials they were upside down.

We may conclude that: (1) In the first half of the second year children are definitely in the scribbling stage of drawing.

(2) Children between two years and six months and three years are emerging from the scribbling stage into the stage of angular drawing, some of which are occasionally named.

(3) In the first half of the third year they still employ both angular and circular movements, but they also attempt to present objects; their favorite subject being a house, which is contrary to the findings of Stern, Tracy (5), and others, who state that the favorite subject is a man. It is possible that a house was the favorite subject with this group because they

had played with blocks and built houses.

(4) The second half of the third year they eliminate the scribbling entirely and extend their scope of objects presented by drawings.

(5) The majority of children under three do not show great interest in color.

TABLE 2

Scores for tossing of bean bags

NUMBER OF SUCCESSES	DISTANCES IN FEET FROM BOARD		
	3	4	5
Large bags			
0	10	18	20
1	10	4	4
2	5	1	None
3	None	2	1
Small bags			
0	9	16	20
1	8	5	2
2	6	1	None
3	None	1	1

(6) The drawings do not conform to the visual perception, but are eivdently merely a symbol—an idea. To the child they represent the expression of the idea in mind.

TOSSING OF BEAN BAGS

In this performance the child was asked to throw a bean bag through a hole in a board. The board used was 12 inches square with a hole 10 inches in diameter and stood on legs on the floor. Each child was given 3 bean bags that were 5½ inches square and that weighed 7½ ounces. The distances for throwing the bags into the hole were 3 feet, 4 feet, and 5 feet. The child was given 3 trials at each distance and the same procedure was followed for 3 days.

The directions were for the child to stand back of the line and throw the bags through the hole. He was encouraged to do his best. However, if he stepped over the line the trial was repeated.

After having the children do the experiment for three times, it was decided to change the size of the bean bags to discover if the size of the bean bag interfered with the ability to throw the bag through the hole. The bags now weighed 3½ ounces and were 2½ inches square. Three trials were given with the smaller bags. Results from the two procedures are given in table 2.

CONCLUSIONS

1. More bags were thrown through the hole at 3 feet than at 4 or 5 feet. Accuracy decreased as the distance increased.

2. The weight of the bags did not change their ability to throw. They aimed just as well with the large bags as with the smaller bags. The individual scores in most of the cases were the same. The ability to throw and aim accurately seems to depend largely upon the physical development of the child. Children vary in muscular control as they do in height and weight.

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